Study of Driving Forces for Atomic Migration in Dilute Alloys

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We present a pseudopotential calculation of the driving forces for atomic migration in the 156 dilute alloys of the 23 host of the different groups of the periodic table in the presence of electron currents. The forces on an atom arising from the applied electric field and from the electron scattering together comprise the driving force, causes a net current of atoms. A well recognized Ashcroft's empty core (EMC) local model potential is used to investigate the driving forces for interstitial (F_{INT}), vacancy (F_{VAC}), substitutional (F_{SUB}) and nearest neighbour (F_{NN}) migration in dilute alloys. Five different types of the local field correction functions proposed by Hartree (H), Taylor (T), Ichimaru-Utsumi (IU), Farid et al (F) and Sarkar et al (S) are used to study the effect of the exchange and correlation on the aforesaid properties. The driving forces are calculated for interstitial, vacancy, substitutional and nearest neighbour migration in dilute alloys, and the results are found to compare qualitatively with most experimental data. The present study concludes that F_{INT} is larger than F_{VAC}. For some dilute alloys the electron scattering force is found in the opposite direction to the electron drift velocity. Present findings are compared with the other such data, which confirms the applicability of the model potential.

Keywords: model potential, driving forces, atomic migrations, dilute alloys

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I. INTRODUCTION

The application of an electric field to a metal gives rise to a current of electrons and to a considerably smaller current of atoms. Migration of atoms / electrons occurs in metals, semiconductors or alloys due to the application of electric field are known as atomic migration / electromigration. It is primarily applied to those cases of mass transport where the charge transport number is small. The phenomenon, electromigration is a subject of fundamental and technological interest. From fundamental point of view electromigration is important because it involves microscopic electric fields and subtle dynamical processes occurring into coupled electron and atom transport, while from technology point of view it is important because it is a major failure mechanism in an operation of solid-state electronic devices [1-18]. The practical aspects of electromigration seemed for a long time rather minor. In the metal, all interstitials tend to move in the same direction under current flow and this fact facilitate the simultaneous elimination of many trace impurities in the same electromigration treatment. Thus, for the purification of materials electromigration technique is useful [1-18]. The phenomenon of electromigration is the transport of atoms in a metallic system that is subjected to an electric field and the accompanying 'electron wind'. The treated as impurity defects. This is also known as electron scattering [10-12]. Bosvieux and Friedel [14] introduce a charge polarization model, in which the force on the atom is determined by the microscopic electron charge distribution acting on the bare ion. For the calculation of this force they assumed that the perturbed electron density consists of two independent contributions : (1) arise from the incident electrons that are scattered by the atom (or by the defect complex, in general). For an isolated impurity atom in an electron gas it was found that this contribution is precisely the electron scattering force of the ballistic model and (2) arise from the electrostatic field acting on the ion core, including the effects of any static polarization response associated with the atom. This contribution was found to vanish an interstitial impurity, thereby leading to the conclusion that there is no direct force on an interstitial.

The calculation of the electron scattering force using the Bosvieux-Friedel technique shows a great advancement in the electromigration theory [12]. However, there are three difficulties with this calculation as follows : (1) it is not clear how to model the bare potential for general defect complexes, (2) the use of perturbation theory for ion potentials in an electron gas is of doubtful validity and (3) the free electron model does not adequately treat band-structure effects.

To overcome these difficulties, a pseudopotential method based calculation of the electron scattering force was undertaken [1,7-12, 15]. A pseudopotential based theory of the driving forces for electromigration in metals was developed by Sorbello [7-12] in the past. Recently, Vora [15] has been reported the driving forces for atomic migration in the some metals and their dilute alloys by model potential formalism. Also, theory of electromigration is modified by Lodder [16, 17]. From the literature survey it is found that, nobody can perform this type of computation of the driving forces in the recent years with the help of model potential formalism. Hence, in the present paper, we thought it worthwhile to under take the investigation of the driving forces for atomic migration for 156 dilute alloys of the metals of the different groups of the periodic table on the basis of single parametric model potential formalism. Ashcroft's empty core (EMC) model potential [20] along with the screening functions due to Hartree (H) [21], Taylor (T) [22], Ichimaru-Utsumi (IU) [23], Farid et al (F) [24] and Sarkar et al (S) [25] are used for the first time to study the screening dependence of the driving forces for atomic migration. The motivation of the present investigation comes from the fact that there are few scattered attempts of studying the driving forces for atomic migration of metals and dilute alloys [1, 7-13, 15] but nobody have fully explored the investigation for large number of alloys on the basis of single model potential with the same criteria to determine the parameter of the potential. The present computation is performed at the room temperature.

II. COMPUTATIONAL METHODOLOGY

The behavior of electrons and atoms can be known from the adiabatic approximation, also known as Born–Oppenheirmer approximation [1,10-12, 15, 18]. For a system in equilibrium the adiabatic picture is well established and the electron dependent force on the j^{th} ion is given by [1, 10-12, 15, 18]

$$F_j = -\int n(r)\frac{\partial V_o}{\partial R_j}dr \qquad (1)$$

where $n(r)$ is the electron density, V_O is the bare electron interaction potential and R_j is the coordinates of the j^{th} ion. The integration is over the all electron coordinates r.

In the presence of electron current the adiabatic approximation is also expected to be valid. For the calculation of force on the atom, it must be permissible to ignore ion dynamics in electron impurity scattering. The scattering is very predominantly elastic or recoilless [19]. Thus very few phonons are generated, and the ion dynamics may be therefore ignored in the vast majority of scattering events. Thus now it is convenient to separate the quantities n and F_j appearing in equation (1) as $n=n^O+n^1$, and $\mathbf{F_j}=\mathbf{F_j^0}+\mathbf{F_j^1}$, where superscript '1' denotes the quantities due to the electron current, while '0' superscript denotes the quantities in the absence of the electron current. With this conventional notation, electron scattering force $\mathbf{F}_j^1$ is given by [1, 10-12, 15, 18],

$$F=-\int n^1(r)\frac{\partial V_o}{\partial R_j}dr \qquad (2)$$

Where $n^1(r)$ is the charge density arising from the electron current, and is given by [1, 10-12, 15, 18],

$$n^1(\mathbf{r})=\frac{im^2\Omega}{16\pi^4}\int\langle\mathbf{k}+\mathbf{q}|W|\mathbf{k}\rangle\frac{\mathbf{q}\cdot\mathbf{v_d}}{\mathbf{q}\varepsilon(q)}\theta(2k_F-q)e^{i\mathbf{qr}}\,d\mathbf{q} \qquad (3)$$

where $\mathbf{v}_d$ is the electron drift velocity and $\theta(x)=1$ if x > 1, otherwise vanishes. $\int\langle\mathbf{k}+\mathbf{q}|W|\mathbf{k}\rangle$ is the model pseudopotential.

The electron scattering force in terms of potential function is of the form [18]

$$\mathbf{F_j^1}=-\frac{\partial\mathbf{U}_j^1}{\partial\mathbf{R}_j^1} \qquad (4),$$

where $\mathbf{U}_j^1=-\sum_{\substack{n\\ vacancies}}u_{jn}+\sum_{\substack{i\\ impurities}}u_{ji}$ (5).

Equations (4) and (5) show that the electron scattering force on an ion is negative value of charge of an effective potential U^1, which involves two body effective interaction between the ion and all defects and also one body interaction giving rise to a constant force on any ion which is a defect. The effective interaction or potential as a function of R and θ, where θ to be the angle between the electron drift velocity v_d and lattice site R, is given by [1, 10-12, 15, 18],

$$u(R,\theta)=-\frac{\Omega_O^2 mk_F}{4\pi^3\hbar^2}\left(\frac{v_d}{v_F}\right)\cos\theta\,\mathbf{x}\int_0^{2k_F}W(q)^2q^2j_1(qR)\,dq \qquad (6)$$

Here $j_1(qR)$, V_F and $V_d=1/ne$ are the spherical Bessel's function, Fermi velocity and the electron drift velocity in which, n and e are the electron concentration and charge of electron, respectively. Also, m,Ω_O and k_F are the

electronic mass, anomic volume and Fermi vector. The equations (1-6) are the general expression for the electron scateering force, we may now advance to our primary goal, namely the calculation of the forces for geometris relavent to elecromigration. The force on the ion at R arising from this two-body interaction is simply

$$f_1(R) = -\frac{\partial u}{\partial \mathbf{R}} = \frac{\Omega_O^2 m k_F}{4\pi^3\hbar^2}\left(\frac{v_d}{v_F}\right)\cos\theta \int_0^{2k_F} W(q)^2 q^3 j_1'(qr)\,dq \qquad (7)$$

with $j_1' = \dfrac{\partial j_1}{\partial R}$.

The force that is of interest for the electromigration problem is only the force, which is effective in preferentially lowering the barriers for diffusion along a given direction. True local field may depend on the position of the atom along the diffusion jump path. The only part force field that is relevant for electromigration is the part that given rise to a net change in barrier height refers to the difference in barrier height between a forward jump and backward jump along the jump path [4, 9-12]. The change in the barrier height is equal to the net work done on the ion by the true force as the ion is moved from initial to final sites over the entire jump path. The driving force for the electromigration is the average of the true force over the diffusion jump part, when the electron drift is taken along the jump path [1, 9-12, 24].

II.1 Interstitial diffusion force (F_{INT})

Some atoms may occupy interstitial position in the crystal lattice and may move by jumping into a neighboring interstitial site. We shall ignore distortions of the crystal during the jump, and therefore consider the other atoms of the crystal to be at their regular lattice sites. The driving force for electromigration, F_{INT}, i.e. the force on an interstitial is given by [1, 10-12, 15, 18],

$$F_{INT} = \frac{\Omega_O^2 m k_F}{12\pi^3\hbar^2}\left(\frac{v_d}{v_F}\right)\int_0^{2k_F} W(q)^2\, q^3\, dq \qquad (8)$$

For the interstitial force in the case of dilute alloys, we require pseudopotential for an impurity in its native lattice and restrict our calculation to alloys for which the solute and solvent species have similar electron densities in their native crystals. We are defining $W'(q)$ as the form factor of solute which is obtained by multiplying species i.e. Ω_O'/Ω_O hence, for dilute alloys the equation (8) becomes,

$$F_{INT} = \frac{\Omega_O m k_F}{12\pi^3\hbar^2}\left(\frac{v_d}{v_F}\right)\int_0^{2k_F} W'(q)^2\, q^3\, dq \qquad (9)$$

II.2 Vacancy diffusion force (F_{VAC})

The most elementary point defect in a metal is vacancy. In thermal equilibrium, any crystals at a temperature above zero contain number of vacant lattice sites. These vacancies provide an easy path for diffusion. The elementary atom jump in the vacancy mechanism is the jump of an atom in to a neighboring vacancy. The site previously occupied by the atom then is vacant, so that in effect the atom and vacancy merely exchange position. Each atom moves through the crystal by making a series of exchanges with the various vacancies, which from time to time are in its vicinity. The driving force F_{VAC} is given by [1, 10-12, 15, 18],

$$F_{VAC} = -\frac{\Omega_0^2 m k_F}{12\pi^3\hbar^2}\left(\frac{v_d}{v_F}\right)\mathbf{x} \left\{\frac{2}{\ell}\int_0^{2k_F} W(q)^2\, q^2\, j_1(q\ell)\,dq - \frac{1}{3}\int_0^{2k_F} W(q)^2\, q^3 dq\right\} \qquad (10)$$

The driving force of electromigration in the vacancy mechanism for dilute alloys can be expressed by replacing $W(q)^2$ by $W(q)W'(q)$ in the first integral and by $W'(q)^2$ in the second integral. Hence equation (10) is modified by

$$F_{VAC} = -\frac{\Omega_O^2 m k_F}{12\pi^3\hbar^2}\left(\frac{v_d}{v_F}\right)\mathbf{x} \left\{\frac{2}{\ell}\int_0^{2k_F} W(q)W'(q)\, q^2\, j_1(q\ell)\,dq - \frac{1}{3}\int_0^{2k_F} W'(q)^2\, q^3 dq\right\} \qquad (11)$$

here $W(q)$ and $W'(q)$ are the form factors associated with the host and impurity metal, respectively. Also, $\ell = R_{NN}/a_O$ is the jump distance, in which R_{NN} is the nearest-neighbor distance and a_O the Bohr radius. The expression of $j_1(q\ell)$ is given by,

$$j_1(q\ell) = \left[\frac{\sin(q\ell)}{(q\ell)^2} - \frac{cos(q\ell)}{(q\ell)}\right] \qquad (12)$$

II.3 Substitutional diffusion force F_{SUB}

In the case of dilute alloys, the driving force of electromigration on isolated substitutional impurities are also important and can be calculated under the vacancy diffusion mechanism. The

driving force on the substitutional impurities F_{SUB} for dilute alloys is expressed as [1, 10-12]

$$F_{SUB} = \frac{\Omega_O^2 m k_F}{12\pi^3\hbar^2}\left(\frac{v_d}{v_F}\right)\mathbf{x} \int_0^{2k_F} W'(q)[W'(q)-W(q)]q^3 dq \qquad (13)$$

2.4 Nearest neighbour diffusion force (F_{NN})

In the case of vacancy diffusion, there is another force F_{NN}, the electron scattering force exerted on a nearest neighbor to a vacancy. This is a relevant force on the nearest neighbor lattice atom to the vacancy since this is the atom, which will jump into the vacancy and is given by [1, 10-12]

$$F_{NN} = -\frac{\Omega_O m k_F}{12\pi^3\hbar^2}\left(\frac{v_d}{v_F}\right)\frac{2}{\ell}\mathbf{x} \int_0^{2k_F} W(q)W'(q)\, j_1'(qR_{NN})\, q^3\, dq \qquad (14)$$

where R_{NN} is the nearest-neighbor distance and it is assumed that the nearest-neighbor is an impurity up-wind from the vacancy and $j_1'(qR_{NN})$ is written by

$$j_1'(qR_{NN}) = \frac{\partial j_1}{\partial(qR_{NN})} = \left[-\frac{2\sin(qR_{NN})}{(qR_{NN})^3} + \frac{\sin(qR_{NN})}{(qR_{NN})} + \frac{2\cos(qR_{NN})}{(qR_{NN})^2}\right] \qquad (15)$$

II.4 Model potential ($W(q)$)

In the present work, we have calculated driving forces for dilute alloys by applying Ashcroft's well known empty core (EMC) model potential [20] including three different types of the local field correlation functions [21-25]. The form factor explored in the present investigation is of the form [20],

$$\mathbf{W(q)} = \frac{-4\pi \mathbf{Z e^2}}{\Omega_O\, q^2\, \varepsilon(q)}\cos(qr_C) \qquad (16)$$

where, Z is the valence, Ω_O the atomic volume, r_C the parameter of the potential and $\varepsilon(q)$ the modified Hartree dielectric function [21]. The parameter of the model potential r_C is determined using the first zero of the form factor [15, 22].

I².5 Effective driving force (F_{eff})

According to the Huntington et al.. [7-9], the external field is not screened appreciably so the net contribution from the applied field is ZeE, while according the Bosvieux and Friedel [14] the applied electric field causes the local screening field, which exactly cancels the applied fields. The effective driving force for electron migration F_{eff} in alloys is given by:

$$F_{eff} = F + ZeE \qquad (17)$$

for vacancy migration $F = F_{VAC}$, for interstitial migration $F = F_{INT}$, for isolated substitutional impurity $F = F_{SUB}$ and for nearest neighbour to a vacancy $F = F_{NN}$. Since v_d is opposite to electric field E, equation (17) can be expressed as

$$F_{eff} = Z^* eE \qquad (18)$$

where $Z^* = Z\left[1-\frac{\kappa}{\rho}\right]$ (19)

Z^* is dimensionless effective valence and κ is a parameter with which to measure the strength of the electromigration effect, and is used universally [1, 10-12].

$$\kappa = \frac{F}{Zej} \qquad (20)$$

By taking $F = F_{VAC}$, $F = F_{INT}$, $F = F_{SUB}$ and $F = F_{NN}$ with $j = 1\, Amp/cm^2$, the constants κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN} are calculated from the relation given by in equation (20).

III. RESULTS AND DISCUSSION

The input parameters and other constants used in the present computation of the driving forces in dilute alloys are narrated in Table 1. The present results regarding the electromigration driving forces F_{VAC}, F_{INT}, F_{SUB}, F_{NN} and quantities relevant to the electromigration κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN} for 45 dilute alloys are tabulated in Tables 2-9. The results are comparable and compatible with such other theoretical results [10, 15].

From the Tables 2-9, it is noted that, the presently computed results of the relevant forces F_{VAC}, F_{INT}, F_{SUB}, F_{NN}, κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN} are found in qualitative agreement with the theoretical [10, 15] and experimental [10] data. In all cases, the forces are for the migration of the solute ion. The forces on the host atoms are assumed to be identical to those in the pure metal. From Tables 2-9 we see that the computed forces are all in the direction of the electron drift velocity, and that for given most of

the dilute alloys, F_{INT} is considerable larger than F_{VAC} because an ion that moves between two vacant sites experiences the fields of individual dipoles centered at each vacant site and these vacancy dipoles are oriented opposite to the dipole carried by the moving ion. It is also caused by the two vacancies which are part of the structure of the 'activated complex' for vacancy diffusion. Further evidence of the importance of structural effects is provided by the fact that F_{NN} and F_{VAC} are generally quite different although F_{NN} is the force on an atom before it jumps into a vacancy and F_{VAC} is the average force over the jump. It is interesting to note that, the several values of the F_{SUB} are negative, so that substitutional impurity may feel an electron scattering force opposite to the electron drift while F_{SUB} are positive, because of an electron scattering force in the direction of the electron drift. We have noted that for electron, scattering by an interstitial impurity, the net momentum lost by the electrons is absorbed by the interstitial, with the remainder of the crystal receiving no net momentum. While for electron scattering by vacancy, the momentum lost by the electron to the entire crystal is the same as that lost in interstitial scattering. Also, as an ion moves into a vacancy, the force it feels varies markedly with position [10].

The effective driving force for electromigration is the average of the true force on an ion as it undergoes a diffusion jump. The present results of the driving forces arising from the electron scattering showed that this force is smaller for vacancy diffusion than for interstitial diffusion because of interference effects associated with the structure of the scattering complex as an ion moves between two vacancies [10]. It was also found that the net driving forces for electromigration, including also the applied electric field, pushes the atoms in the direction of the electron drift in the case of dilute alloys. For some alloys the force may be reversed. The present findings of the driving forces for most of the dilute alloys, the results due to H-local field correction function are found in qualitative agreement with the reported data [10, 15]. It is noted from the Tables 2-9 that, among the three employed local filed correction functions, the local field correction function due to H (without exchange and correlation) gives the minimum numerical value of the relevant forces, while the local field correction function due to F gives the maximum value.

The results displayed in Tables 2-9 indicate that the present calculations are sensitive to choice of the form factor. However, similar trends are found in present results and in Sorbello's [10-12] calculations. In comparison with the static H-function, the percentile influences of various local field correction functions viz. T, IU, F and S are found for F_{INT} of the order of **9.66%-107.14%, 35.61%-90.73%, 20.16%-100.56%, 38.35%-118.42%, 39.95%-134.23%, 9.64%-87.13%, 26.17%-619.25%, 30.81%-360.92%, 14.31%-77.73%, 22.77%-76.04%, 20.03%-59.45%, 20.62%-71.40%, 16.89%-67.96%, 21.94%-56.37%, 19.20%-58.97%, 19.43%-69.70%, 18.30%-52.85% and 20.34%-56.56% of *Li, Na, K, Rb, Cs, Cu. Ag, Au, Be, Mg, Zn, Cd, Al, In, Sn, Pb*** and Bi-based dilute alloys, respectively. Large percentile differences are found for ***Na-Cu*** and ***Cu-Ge*** dilute alloys. While those influences for F_{VAC} are of the order of **40.46%-242.25%, 40.31%-217.90%, 32.19%-125.32%, 49.96%-124.67%, 61.74%-168.11%, 21.13%-146.25%, 33.59%-96.13%, 33.57%-95.68%, 14.56%-67.57%, 28.15%-82.24%, 22.19%-69.98%, 28.40%-79.51%, 18.57%-75.97%, 24.01%-64.67%, 21.15%-67.09%, 21.33%-84.31%, 19.54%-59.02%** and **21.77%-62.87%** of ***Li, Na, K, Rb, Cs, Cu. Ag, Au, Be, Mg, Zn, Cd, Al, In, Sn, Pb*** and Bi-based dilute alloys, respectively. Large percentile difference is found for ***Be-K*** dilute alloy. The percentile influences of various local field correction functions viz. T, IU, F and S with H-function are found for F_{SUB} of the order of **43.11%-733.33%, 30.54%-161.77%, 32.88%-138.57%, 52.58%-166.99%, 54.97%-968.89%, 22.90%-86.10%, 25.72%-101.62%, 32.13%-102.96%, 13.17%-57.70%, 6.45%-519.42%, 21.11%-77.67%, 24.19%-472.29%, 1.24%-144.47%, 0.42%-131.90%, 2.79%-72.27%, 4.84%-881.94%, 13.07%-36.48%** and **20.84%-70.21%** of ***Li, Na, K, Rb, Cs, Cu. Ag, Au, Be, Mg, Zn, Cd, Al, In, Sn, Pb*** and Bi-based dilute alloys, respectively. While those influences for F_{NN} are of the order of **17.24%-585.71%, 6.03%-248.30%, 29.71%-144.73%, 16.33%-229.93%, 47.46%-149.80%, 2.253%-108.43%, 0.91%-400.00%, 4.63%-279.45%, 12.17%-52.40%, 0%-170.20%, 23.46%-400.00%, 1.26%-100.81%, 0.90%-433.79%, 3.98%-30.58%, 1.34%-134.66%, 16.21%-61.04%** and **15.10%-511.43%** of ***Li, Na, K, Rb, Cs, Cu. Ag, Au, Be, Mg, Zn, Cd, Al, In, Sn and Pb*** based dilute alloys, respectively. Large percentile differences are found for ***K-Na***, ***Cu-Na***, ***Ag-Au*** and ***Bi-Pb*** dilute alloys. Also, large discrepancies are found in the computation of F_{VAC}, F_{INT}, F_{SUB} and F_{NN} often occur in the present results obtained with EMC model potential with the Sorbello's data [10-12] for the same systems in the case of dilute alloys.

It is also noted from the Tables 2-9 that, for Li-based dilute alloys, as we move from Na→Cs, the force F_{INT} increases for Li-Na, Li-K, while for Li-Rb and Li-Cs dilute alloys, F_{INT} decreases. The same is true for Na-based dilite alloys. No specific trend is predicted for K, Rb and Cs-based dilute alloy of alkali metals. The present results are following the trend of other such findings. In the Cu-based dilute alloys the F_{INT} is minimum for Cu-Ge while maximum for Cu-Ca. For Ag-based dilute alloys, Ag–Al require minimum force F_{INT} while is maximum for Ag-Ba. The force on an interstitial is found negative for some Ag-based dilute alloys, which suggests that the electron scattering forces experienced by solute atom are in opposite direction to the electron drift. Au–Ba dilute alloy experiences maximum interstitial force and Ag-Al minimum in the group of Au-based dilute alloys. For some Au-based dilute alloys, the values of F_{INT} is found to negative. When Be is solute, the maximum and minimum interstitial force experienced by the system is for Be–K and Be–Pb, respectively. Here also, negative value of F_{INT} is found for for Be-K dilute alloy. In the case of Mg-based systems, the minimum F_{INT} is for Mg-K and maximum is for Mg-Pb. Also, Zn-Cu and Zn-Pb have the minimum and maximum values of F_{INT} in Zn-based dilute alloys. In the case of Cd-based systems, the minimum F_{INT} is for Cd-Cu and maximum is for Cd-Al. In the Al-based dilute alloys the F_{INT} is minimum for Al-K while maximum for Al-Pb. When In is solute, the maximum and minimum interstitial force experienced by the system is for In–Cd and In–Bi, respectively. For Sn-based dilute alloys, Sn-Sb require minimum force F_{INT} while is maximum for Sn-Cu. In the case of Pb-based systems, the minimum F_{INT} is for Pb-K and maximum is for Pb-Bi. In the Sb-based dilute alloys the F_{INT} is minimum for Sb-Mg while maximum for Sb-Pb. Same observations are found for F_{VAC}, F_{SUB}, F_{NN}, κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN}, respectively. In general it is found that solvent of higher atomic volume requires greater forcees. Out of 156 dilute alloys Bi–Pb alloy felt maximum forces.

It is interesting to note from the Tables 2-3 that, the magnitude of the interstitial forces F_{INT} and the vacancy forces F_{VAC} for Li, Na, Cu and Ag based dilute alloys are negative, so that interstitial or vacancy impurity may feel an electron scattering force opposite to the electron drift while the magnitude of both forces are positive, because of an electron scattering force in the direction of the electron drift.

Tables 6-9 also display the values of κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN} for diffusion in dilute binary alloy systems. Although diffusion in alloys in generally assumed to occur via the vacancy mechanism, there is evidence that in some alloys diffusion occurs via the interstitial, substitutional and nearest neighbour mechanisms. For this reason we have computed κ for all the mechanism. However, Sorbello [10-12] has been reported κ for both vacancy and interstitial mechanisms. We have limited our choice of alloys to those comprised of elements having values of k_F that are typically within 10% of each other, so that the use of EMC paseudopotential is reasonable. The presently computed results of κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN} are not found in qualitative agreement with the theoretical [10] or experimental [10] data, because of the sensitivity of the computations to choice of form factor and also, the uncertain reliability of some experimental data [10]. The computed values of κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN} are anomalously higher or lower with the experimental [10] or theoretical [10] data may be due to some alteration of the diffusion-migration mechanism in the presence of high fields and currents. It is interesting to note that the several values of κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN} are high or small enough to be comparable to alloys resistivities.

As is apparent from equation (18), the direction of the net driving forces depends on the sign of Z^*, which by equation (19) depends of the size of κ relative to ρ. It turns out that for each dilute alloys in Tables 2-9, the computed values of κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN} is considerable larger than the resistivity. It then follows that Z^* is negative, and therefore, the ion migrates in the direction of the electron drift. This is also confirmed by the experiments also [10-12].

The effect of local field correction functions plays an important role in the computation of the driving forces in the case of dilute alloys, which makes drastic variation on κ_{INT}, κ_{VAC}, κ_{SUB} and κ_{NN}. The local field correction functions due to IU, F and S are able to generate consistent results regarding the driving forces of the dilute alloys as those obtained from more commonly employed H and T-function. Thus, the use of these more promising local field correction functions is established successfully.

As the experimental observations for driving forces are not available in the literature, the comparison is made with the results of Sorbello [10-12] and Vora [15]. Hence, the presently computed findings will serve a reference system in future for further comparison. Though there are very important aspects in solid state devices the area of theoretical research in the driving forces till requires more attention. The analysis and the comparison with other data are not leading to any definite conclusion. The influence of various forms of local field correction is very strong on the F_{VAC}, F_{INT}, F_{SUB} and F_{NN}.

IV. CONCLUSIONS

From the present study, it is concluded that the model pseudopotential theory is able to generate the consistent results of the driving forces in atomic migrations in the dilute alloys. The driving forces of dilute alloys of the different groups of the periodic table using EMC model potential with three different types of local field correction functions is reported for the first time. The EMC model potential with more advanced IU, F and S-local field correction functions generate consistent results regarding the driving forces. Hence, the EMC model potential is found suitable for studying the driving forces of dilute alloys. The calculated forces are found in qualitative agreement with the reported data. Also, the numerical results are rather sensitive to the proper choice of form factor. F_{INT} is found greater than the F_{VAC} in most of the dilute alloys. Such study on atomic migration force in other metals and dilute alloys is in progress.

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Table 1. Input parameters and constants used in the present calculations.

Metal	Z	Ω_O (au)	r_C (au)	Electron Concentration (n) (x 10^{22} cm^{-3})	Fermi Velocity (v_F) (x 10^8 cm/s)	Nearest Neighbour Distance (R_{NN}) (Å)
Li	1	144.9	2.4528	4.70	1.29	3.023
Na	1	254.5	2.0232	2.65	1.07	3.659
K	1	481.4	2.637	1.40	8.60	4.525
Rb	1	587.9	2.621	1.15	8.10	4.837
Cs	1	745.5	3.591	9.10	7.50	5.235
Cu	1	79.4	0.9888	8.45	1.57	2.56
Ag	1	115	1.2877	5.85	1.39	2.89
Au	1	114	0.9978	5.90	1.39	2.88
Be	2	54.4	1.3442	2.42	2.23	2.22

Mg	2	155.9	1.7136	8.60	1.58	3.2
Ca	2	290	2.1912	4.60	1.28	3.95
Zn	2	102	1.3492	1.31	1.82	2.66
Cd	2	144.8	1.5941	9.28	1.62	2.98
Hg	2	157.8	2.0029	1.43	1.58	3.01
Al	3	111.3	1.373	1.80	2.02	2.86
In	3	175.3	1.3902	1.15	1.74	3.25
Tl	3	191.7	1.3899	3.50	1.69	3.46
Ga	3	131.4	1.3787	1.53	1.91	2.44
Sn	4	181.5	1.338	1.45	1.88	2.81
Pb	4	203.4	1.38	1.45	1.82	3.5
Ge	4	151.8	1.2412	4.42	2.01	2.45
Sb	5	204	1.3136	3.31	1.97	2.91
Bi	5	239.4	1.8324	2.82	1.86	3.07

Table 2. The force on an interstitial (F_{INT}) for dilutes alloys [10^6 / j (amps/cm^2)] (in eV/cm)

Dilute Alloys		Present Results					Others
Solute	**Solvent**	**H**	**T**	**IU**	**F**	**S**	**[10, 15]**
Li	**Na**	121.53	214.72	227.65	233.85	167.44	93
Li	**K**	152.02	271.59	289.65	297.25	211.25	-
Li	**Rb**	151.01	269.69	287.56	295.11	209.78	-
Li	**Cs**	137.72	249.59	270.55	276.50	194.65	-
Li	**Cu**	95.76	161.81	171.55	173.02	137.39	-
Li	**Ag**	94.84	154.77	165.38	165.55	135.11	231
Li	**Au**	96.27	168.69	177.37	180.28	139.13	278
Li	**Mg**	86.50	176.77	179.18	188.21	128.51	93
Li	**Cd**	30.24	14.35	3.05	1.91	27.32	114
Na	**Li**	107.23	188.24	199.02	204.52	147.08	49
Na	**K**	144.68	257.82	274.54	281.82	200.63	128
Na	**Rb**	144.31	257.12	273.76	281.03	200.09	-
Na	**Cs**	82.26	132.89	136.02	140.22	106.94	-
Na	**Cu**	-1.89	-73.57	-91.51	-97.77	-29.45	-
Na	**Ag**	66.50	113.74	110.08	114.70	91.48	-
Na	**Au**	63.38	105.18	100.85	104.98	85.95	-
K	**Li**	65.57	93.08	90.10	93.34	78.79	-
K	**Na**	87.74	158.66	166.14	171.10	123.90	63
K	**Rb**	96.37	178.46	187.30	193.28	137.29	-
K	**Cs**	95.70	176.91	185.63	191.54	136.25	71
Rb	**Li**	102.85	204.41	216.53	224.65	150.36	-
Rb	**Na**	71.05	121.44	126.54	129.66	98.30	-
Rb	**K**	91.72	167.72	175.81	181.23	130.06	-
Rb	**Cs**	91.49	167.19	175.25	180.65	129.70	-
Cs	**Li**	86.86	151.57	158.29	161.52	124.04	-
Cs	**Na**	78.82	129.05	134.89	136.44	110.31	-
Cs	**K**	94.53	173.46	181.04	185.95	137.23	-
Cs	**Rb**	118.41	254.24	265.04	277.35	181.25	-
Cu	**Li**	120.44	197.08	209.60	214.01	157.48	-
Cu	**Na**	116.01	189.36	200.90	205.26	151.23	-
Cu	**K**	119.79	196.47	209.56	213.78	157.16	-
Cu	**Rb**	120.08	196.91	209.98	214.22	157.49	-
Cu	**Cs**	36.82	61.39	68.69	68.90	50.83	-
Cu	**Ag**	120.89	198.03	210.87	215.22	158.30	-
Cu	**Au**	120.89	198.02	210.85	215.20	158.29	-
Cu	**Ca**	222.25	362.10	383.59	392.08	289.16	-
Cu	**Ba**	241.39	395.62	421.53	430.15	316.32	-
Cu	**Be**	31.60	43.71	42.81	44.34	36.61	-
Cu	**Mg**	133.09	212.66	222.91	228.34	170.42	113
Cu	**Zn**	33.07	46.14	45.40	46.99	38.54	200
Cu	**Cd**	102.26	161.27	168.04	172.31	129.69	139
Cu	**Hg**	194.76	315.78	333.47	341.10	252.27	-
Cu	**Al**	84.57	127.35	129.98	133.73	103.83	-
Cu	**Ga**	62.52	90.68	90.95	93.84	74.80	-
Cu	**In**	67.53	99.02	99.82	102.91	81.40	-
Cu	**Ge**	2.71	-13.13	-21.28	-20.62	-6.32	-
Cu	**Sn**	59.58	81.37	79.20	82.12	68.45	348
Cu	**Sb**	56.56	71.95	67.35	70.28	62.01	-
Ag	**Li**	150.93	260.65	278.09	284.69	205.24	63
Ag	**Na**	135.72	233.72	248.73	254.81	183.93	-
Ag	**K**	162.41	281.10	300.70	307.60	221.56	-
Ag	**Rb**	161.66	279.77	299.21	306.09	220.49	-
Ag	**Cs**	121.85	211.97	231.04	234.78	169.40	-
Ag	**Cu**	121.72	208.99	221.92	227.48	164.43	-
Ag	**Au**	156.35	270.29	288.70	295.45	212.91	300

Ag	**Mg**	104.52	173.45	180.46	185.88	136.76	100
Ag	**Zn**	-27.06	-57.72	-67.28	-67.63	-44.28	-
Ag	**Ca**	248.94	427.71	454.36	465.70	336.51	-
Ag	**Ba**	318.15	550.29	588.13	601.78	433.57	-
Ag	**Cd**	62.22	99.09	100.69	104.28	78.50	-
Ag	**Hg**	198.11	338.11	357.56	366.90	266.00	-
Ag	**Al**	3.48	-9.18	-18.07	-16.64	-5.85	-
Ag	**Ga**	-24.42	-58.18	-70.52	-70.33	-44.19	-
Ag	**In**	-18.11	-47.09	-58.66	-58.18	-35.52	-
Ag	**Ge**	-132.30	-252.66	-281.36	-285.58	-195.92	-
Ag	**Sn**	-61.30	-128.21	-148.21	-149.28	-98.42	-
Au	**Li**	151.09	260.60	278.04	284.61	205.29	63
Au	**Na**	136.05	234.00	249.03	255.10	184.22	-
Au	**K**	162.35	280.64	300.20	307.06	221.30	-
Au	**Rb**	161.63	279.34	298.75	305.59	220.25	-
Au	**Cs**	120.44	209.23	228.10	231.75	167.34	-
Au	**Cu**	122.15	209.49	222.44	228.00	164.88	-
Au	**Ag**	156.74	270.62	289.07	295.80	213.27	250
Au	**Ca**	249.77	428.62	455.34	466.66	337.37	-
Au	**Ba**	318.21	549.67	587.46	601.04	433.27	-
Au	**Zn**	-25.77	-55.31	-64.66	-64.95	-42.43	-
Au	**Cd**	63.54	101.33	103.10	106.75	80.26	-
Au	**Hg**	199.19	339.58	359.15	368.50	267.26	-
Au	**Al**	5.45	-5.63	-14.22	-12.69	-3.09	-
Au	**Ga**	-22.47	-54.58	-66.62	-66.33	-41.43	-
Au	**In**	-16.15	-43.51	-54.77	-54.20	-32.75	-
Au	**Ge**	-129.81	-247.81	-276.08	-280.15	-192.24	-
Au	**Sn**	198.26	287.43	304.32	304.78	259.34	-
Be	**Li**	22.64	33.69	36.50	36.83	26.65	-
Be	**Na**	43.43	63.13	66.91	67.87	50.30	-
Be	**K**	-2.47	-2.02	-0.55	-0.95	-2.02	-
Be	**Mg**	164.41	233.56	243.13	247.58	187.93	-
Be	**Tl**	212.55	297.63	308.07	313.79	242.08	-
Be	**Pb**	349.97	497.97	518.83	528.18	400.63	-
Mg	**Li**	134.02	216.50	227.95	233.52	172.17	72
Mg	**Na**	136.21	218.58	229.58	235.18	174.55	-
Mg	**K**	124.88	203.18	214.60	219.84	160.87	-
Mg	**Cu**	134.23	214.22	224.61	230.05	171.67	324
Mg	**Ag**	130.91	212.13	223.64	229.11	168.37	284
Mg	**Be**	107.18	150.11	153.40	155.74	131.71	-
Mg	**Cd**	175.19	265.41	275.20	281.04	220.32	-
Mg	**Al**	197.24	286.83	295.17	300.55	245.04	123
Mg	**In**	180.60	258.68	265.46	269.98	223.37	240
Mg	**Tl**	180.47	258.46	265.23	269.74	223.21	-
Mg	**Sn**	210.75	294.13	300.39	304.88	258.74	-
Mg	**Pb**	234.98	335.06	343.56	349.29	290.25	-
Zn	**Cu**	58.86	88.30	91.47	93.85	70.65	377
Zn	**Al**	176.49	249.58	257.09	261.44	212.88	143
Zn	**Pb**	226.53	318.01	327.43	332.61	273.25	543
Cd	**Li**	100.84	160.73	168.52	172.84	127.63	74
Cd	**Cu**	107.64	169.14	176.66	181.02	135.85	332
Cd	**Mg**	180.89	274.45	284.87	291.05	226.54	117
Cd	**Al**	197.24	284.77	293.58	298.50	244.39	-
Cd	**In**	185.27	264.51	272.28	276.53	229.03	245
Al	**Li**	82.17	123.39	130.82	133.12	98.28	-
Al	**Na**	108.10	160.90	169.43	172.62	128.73	-
Al	**K**	46.69	71.65	77.31	78.42	56.46	-
Al	**Cu**	122.80	181.93	190.94	194.63	145.91	-

Al	**Ag**	67.45	101.96	108.68	110.49	80.94	-
Al	**Be**	196.21	278.41	287.62	293.14	230.41	94
Al	**Mg**	272.47	397.07	413.31	421.62	321.84	146
Al	**Ca**	240.80	357.03	374.92	382.14	286.22	-
Al	**Zn**	197.73	280.73	290.06	295.63	232.21	144
Al	**Cd**	256.53	371.60	386.02	393.75	302.55	-
Al	**Ga**	309.66	441.12	456.16	465.00	363.91	-
Al	**In**	314.60	448.69	464.13	473.15	369.79	307
Al	**Si**	293.58	406.05	416.99	424.39	343.17	-
Al	**Ge**	325.58	454.76	468.08	476.65	381.23	-
Al	**Pb**	413.63	589.31	609.43	621.24	486.11	-
In	**Mg**	205.27	300.86	310.53	317.08	250.39	126
In	**Cd**	197.16	285.48	294.47	300.12	240.53	154
In	**Al**	249.88	348.32	358.68	363.39	304.71	135
In	**Ga**	258.69	363.35	374.27	379.64	315.51	-
In	**Tl**	261.03	367.35	378.42	383.97	318.37	-
In	**Sn**	333.17	464.43	478.24	484.53	406.29	386
In	**Pb**	345.28	485.09	499.67	506.87	421.12	515
In	**Bi**	521.76	772.44	797.74	815.86	636.18	-
In	**Be**	508.93	707.35	729.16	737.36	625.22	-
Sn	**Cu**	122.18	182.36	189.58	194.23	145.64	387
Sn	**Mg**	282.00	410.15	424.16	433.25	336.89	-
Sn	**Cd**	271.58	391.33	404.18	412.38	324.47	-
Sn	**In**	355.44	500.87	515.98	524.95	424.61	286
Sn	**Pb**	469.49	660.62	680.44	692.15	560.84	558
Sn	**Sb**	548.32	763.53	785.58	798.00	654.91	-
Sn	**Bi**	710.61	1041.46	1078.38	1102.49	848.71	-
Pb	**Li**	97.85	150.14	156.79	161.05	117.70	-
Pb	**Na**	121.15	183.86	191.41	196.33	146.11	-
Pb	**K**	64.45	101.02	106.17	109.37	76.97	-
Pb	**Be**	224.58	315.04	324.34	329.44	270.83	-
Pb	**Mg**	288.23	422.53	437.06	446.44	348.22	-
Pb	**Zn**	225.81	317.05	326.44	331.62	272.32	129
Pb	**Cd**	274.42	398.08	411.25	419.52	331.43	-
Pb	**Hg**	289.20	432.00	448.16	458.81	349.36	-
Pb	**Al**	366.59	521.43	537.55	547.01	442.37	-
Pb	**In**	353.37	499.63	514.78	523.43	426.31	277
Pb	**Tl**	353.27	499.46	514.60	523.24	426.18	-
Pb	**Sn**	446.09	625.04	643.42	653.46	537.92	405
Pb	**Bi**	736.04	1088.25	1127.03	1152.40	889.33	-
Sb	**Mg**	1676.38	2424.72	2509.10	2562.39	1983.12	-
Sb	**Pb**	2825.19	3968.96	4089.04	4162.00	3343.03	-
Bi	**Pb**	3771.00	5569.27	5775.20	5903.69	4538.17	-

Table 3. The force for vacancy migration (F_{VAC}) for dilutes alloys $[10^6 / j\ (amps/cm^2)]$ (in eV/cm).

Dilute Alloys		Present Results					Others
Solute	**Solvent**	**H**	**T**	**IU**	**F**	**S**	**[10, 15]**
Li	**Na**	123.69	227.40	242.01	249.13	173.74	55
Li	**K**	160.56	294.80	315.25	323.97	226.16	-
Li	**Rb**	159.31	292.51	312.74	321.41	224.37	-
Li	**Cs**	150.66	277.21	300.91	307.75	214.70	-
Li	**Cu**	42.71	91.84	99.33	101.22	70.65	-
Li	**Ag**	38.50	78.76	86.88	87.31	63.57	185
Li	**Au**	47.03	105.66	112.38	115.90	77.95	234
Li	**Mg**	57.85	149.70	151.67	162.08	96.87	51
Li	**Cd**	-22.44	-60.52	-75.64	-76.80	-40.81	69
Na	**Li**	106.69	196.37	208.51	214.83	149.70	17
Na	**K**	151.55	278.32	297.24	305.60	213.29	77
Na	**Rb**	151.09	277.48	296.32	304.66	212.64	-
Na	**Cs**	57.88	109.07	112.26	117.12	80.29	-
Na	**Cu**	-60.96	-163.82	-186.79	-193.79	-108.19	-
Na	**Ag**	21.15	56.44	50.33	55.75	35.51	-
Na	**Au**	17.39	46.36	39.46	44.32	28.93	
K	**Li**	19.20	40.33	36.35	40.13	25.38	-
K	**Na**	69.63	142.54	150.28	156.01	104.42	21
K	**Rb**	82.52	169.59	179.12	186.01	123.77	-
K	**Cs**	81.49	167.42	176.81	183.61	122.23	82
Rb	**Li**	106.83	223.51	237.98	247.29	161.05	-
Rb	**Na**	46.12	93.54	98.19	101.82	69.24	-
Rb	**K**	75.48	154.79	163.33	169.58	113.19	-
Rb	**Cs**	75.14	154.08	162.57	168.79	112.68	-
Cs	**Li**	44.57	99.04	104.23	108.06	72.28	-
Cs	**Na**	32.49	68.81	72.67	74.59	52.55	-
Cs	**K**	56.46	128.92	135.42	141.16	91.70	-
Cs	**Rb**	103.97	252.41	264.63	278.75	170.06	-
Cu	**Li**	128.77	214.49	228.65	233.66	169.72	-
Cu	**Na**	123.08	204.98	218.04	223.00	161.89	-
Cu	**K**	128.83	214.70	229.49	234.28	170.25	-
Cu	**Rb**	129.09	215.12	229.88	234.71	170.55	-
Cu	**Cs**	39.41	66.74	74.82	75.08	54.92	-
Cu	**Ag**	129.62	215.95	230.47	235.42	171.03	-
Cu	**Au**	129.61	215.92	230.42	235.37	171.00	-
Cu	**Ca**	234.30	390.23	414.57	424.21	307.82	-
Cu	**Ba**	259.15	431.79	461.08	470.88	342.14	-
Cu	**Be**	12.78	23.14	22.03	23.77	15.48	-
Cu	**Mg**	129.88	217.01	228.60	234.77	169.46	35
Cu	**Zn**	14.46	25.92	25.00	26.80	17.69	107
Cu	**Cd**	94.21	157.94	165.56	170.41	122.49	58
Cu	**Hg**	201.72	336.12	356.17	364.83	264.42	-
Cu	**Al**	61.94	105.49	108.36	112.62	79.38	-
Cu	**Ga**	36.56	63.48	63.65	66.94	46.04	-
Cu	**In**	42.33	73.03	73.82	77.32	53.62	-
Cu	**Ge**	-43.99	-68.81	-78.28	-77.52	-60.31	-
Cu	**Sn**	21.38	39.36	36.71	40.03	25.47	211
Cu	**Sb**	6.14	15.12	9.65	13.00	4.81	-
Ag	**Li**	161.04	283.93	303.74	311.24	221.23	17
Ag	**Na**	143.38	253.00	270.06	276.98	196.65	-
Ag	**K**	174.56	307.62	329.84	337.68	240.25	-
Ag	**Rb**	173.67	306.06	328.11	335.93	238.99	-
Ag	**Cs**	131.88	232.50	253.85	258.13	184.55	-
Ag	**Cu**	127.21	224.69	239.40	245.72	174.25	-

Ag	**Au**	167.39	295.06	315.95	323.63	230.13	225
Ag	**Mg**	95.10	170.33	178.42	184.58	128.90	30
Ag	**Zn**	-55.20	-92.82	-103.56	-103.96	-77.44	-
Ag	**Ca**	260.78	460.50	490.83	503.71	357.29	-
Ag	**Ba**	341.21	601.38	644.30	659.82	469.30	-
Ag	**Cd**	46.74	85.65	87.59	91.67	62.44	-
Ag	**Hg**	202.32	358.09	380.29	390.90	276.52	-
Ag	**Al**	-32.50	-51.17	-61.09	-59.45	-47.18	-
Ag	**Ga**	-64.34	-106.92	-120.77	-120.54	-90.86	-
Ag	**In**	-57.14	-94.31	-107.27	-106.72	-80.97	-
Ag	**Ge**	-199.56	-341.74	-374.13	-378.90	-277.14	-
Ag	**Sn**	-118.97	-200.71	-223.23	-224.43	-166.62	-
Au	**Li**	161.27	283.93	303.73	311.20	221.33	19
Au	**Na**	143.80	253.38	270.46	277.36	197.04	-
Au	**K**	174.53	307.13	329.31	337.10	239.99	-
Au	**Rb**	173.67	305.62	327.62	335.40	238.76	-
Au	**Cs**	130.28	229.37	250.47	254.65	182.19	-
Au	**Cu**	127.76	225.31	240.06	246.38	174.83	225
Au	**Ag**	167.88	295.50	316.42	324.08	230.60	174
Au	**Ca**	261.82	461.66	492.06	504.92	358.38	-
Au	**Ba**	341.34	600.75	643.61	659.05	469.04	-
Au	**Zn**	-53.60	-89.90	-100.40	-100.72	-75.18	-
Au	**Cd**	48.37	88.37	90.51	94.65	64.61	-
Au	**Hg**	203.65	359.92	382.24	392.86	278.08	-
Au	**Al**	-30.06	-46.86	-56.42	-54.69	-43.80	-
Au	**Ga**	-61.93	-102.56	-116.05	-115.71	-87.46	-
Au	**In**	-54.72	-89.96	-102.56	-101.91	-77.58	-
Au	**Ge**	-196.46	-335.85	-367.73	-372.34	-272.61	-
Au	**Sn**	91.12	153.14	166.98	167.65	130.15	-
Be	**Li**	24.30	37.16	40.34	40.72	29.06	-
Be	**Na**	43.92	65.27	69.47	70.47	51.41	-
Be	**K**	0.23	2.51	4.31	3.96	1.52	-
Be	**Mg**	154.25	224.13	234.33	238.79	177.42	-
Be	**Tl**	186.63	269.64	280.47	286.16	213.86	-
Be	**Pb**	331.73	482.00	504.30	513.68	382.06	-
Mg	**Li**	122.75	204.33	216.23	221.72	160.06	43
Mg	**Na**	123.08	203.94	215.31	220.81	160.18	-
Mg	**K**	115.80	193.90	205.85	211.03	151.41	-
Mg	**Cu**	119.79	197.84	208.53	213.87	155.70	286
Mg	**Ag**	120.58	201.21	213.20	218.59	157.41	243
Mg	**Be**	64.32	98.95	101.57	103.82	82.45	-
Mg	**Cd**	135.75	218.73	228.24	233.93	175.35	-
Mg	**Al**	134.58	212.22	219.75	224.96	173.19	75
Mg	**In**	117.17	183.07	188.94	193.32	150.57	181
Mg	**Tl**	117.04	182.85	188.71	193.07	150.39	-
Mg	**Sn**	124.88	191.63	196.51	200.83	160.03	-
Mg	**Pb**	150.15	233.91	241.17	246.70	192.85	-
Zn	**Cu**	49.04	77.68	80.97	83.36	59.92	351
Zn	**Al**	123.82	188.62	195.68	200.04	153.21	103
Zn	**Pb**	154.50	234.42	243.15	248.34	191.53	482
Cd	**Li**	91.92	152.33	160.64	165.01	118.45	51
Cd	**Cu**	95.11	156.05	163.94	168.34	122.30	307
Cd	**Mg**	144.35	232.88	243.34	249.55	185.35	81
Cd	**Al**	132.46	208.75	216.83	221.76	170.23	-
Cd	**In**	119.20	186.69	193.63	197.87	153.25	199
Al	**Li**	73.30	112.86	120.17	122.36	88.56	-
Al	**Na**	96.77	147.13	155.46	158.49	116.19	-
Al	**K**	40.83	65.15	70.77	71.85	50.21	-

Al	**Cu**	109.86	166.05	174.82	178.33	131.52	-
Al	**Ag**	59.86	93.14	99.78	101.51	72.70	-
Al	**Be**	161.41	236.69	245.37	250.58	191.54	65
Al	**Mg**	238.68	355.51	371.13	378.99	284.02	107
Al	**Ca**	215.49	326.00	343.43	350.29	258.09	-
Al	**Zn**	162.91	238.97	247.77	253.03	193.33	111
Al	**Cd**	221.89	329.25	343.07	350.37	263.79	-
Al	**Ga**	257.32	378.16	392.38	400.73	305.42	-
Al	**In**	262.22	385.62	400.23	408.75	311.26	255
Al	**Si**	225.53	325.82	335.85	342.82	267.32	-
Al	**Ge**	256.94	373.39	385.73	393.82	304.66	-
Al	**Pb**	343.84	505.35	524.37	535.53	408.12	-
In	**Mg**	160.40	246.26	255.16	261.33	199.32	90
In	**Cd**	152.68	232.09	240.44	245.76	190.17	121
In	**Al**	185.91	274.26	284.16	288.61	233.22	93
In	**Ga**	194.16	288.17	298.55	303.62	243.23	-
In	**Tl**	196.36	291.87	302.38	307.62	245.89	-
In	**Sn**	247.87	365.68	378.88	384.82	310.97	323
In	**Pb**	259.23	384.80	398.66	405.45	324.73	453
In	**Bi**	409.52	634.25	657.32	674.37	507.86	-
In	**Be**	391.81	574.60	596.08	603.88	495.86	-
Sn	**Cu**	100.36	156.24	163.23	167.69	121.16	325
Sn	**Mg**	226.26	343.65	357.10	365.77	274.12	-
Sn	**Cd**	213.83	322.75	335.03	342.84	259.45	-
Sn	**In**	265.35	394.92	409.14	417.69	323.24	183
Sn	**Pb**	349.20	519.25	537.88	549.04	425.50	420
Sn	**Sb**	396.79	586.13	606.69	618.53	484.50	-
Sn	**Bi**	577.43	882.12	917.68	940.69	698.79	-
Pb	**Li**	78.24	125.17	130.97	135.08	94.93	-
Pb	**Na**	100.82	158.13	164.86	169.62	122.61	-
Pb	**K**	46.09	77.56	81.88	84.95	55.57	-
Pb	**Be**	189.30	275.42	284.45	289.44	232.36	-
Pb	**Mg**	248.44	374.73	388.27	397.38	303.50	-
Pb	**Zn**	190.46	277.31	286.42	291.48	233.75	100
Pb	**Cd**	235.84	352.56	364.95	373.00	288.43	-
Pb	**Hg**	247.85	380.70	395.45	405.77	302.13	-
Pb	**Al**	311.83	458.77	474.23	483.45	382.17	-
Pb	**In**	299.45	438.44	453.04	461.48	367.24	232
Pb	**Tl**	299.35	438.28	452.88	461.31	367.12	-
Pb	**Sn**	375.71	546.14	564.01	573.81	461.23	345
Pb	**Bi**	634.35	964.24	1000.05	1024.67	774.18	-
Sb	**Mg**	1375.10	2057.52	2136.43	2186.69	1643.79	-
Sb	**Pb**	2218.54	3250.82	3363.22	3432.04	2664.75	-
Bi	**Pb**	3113.39	4757.02	4949.63	5070.79	3791.09	-

Table 4. The force on an isolated substitutional impurity (F_{SUB}) for dilutes alloys $[10^6 / j\ (amps/cm^2)]$ (in eV/cm).

Dilute Alloys		Present Results					Others
Solute	**Solvent**	**H**	**T**	**IU**	**F**	**S**	**[10, 15]**
Li	**Na**	-12.87	-24.27	-26.31	-27.00	-18.43	34
Li	**K**	17.51	32.33	35.41	36.09	25.22	-
Li	**Rb**	15.97	29.50	32.29	32.93	22.98	-
Li	**Cs**	65.32	112.23	125.91	125.77	95.39	-
Li	**Cu**	7.00	11.67	14.34	13.75	10.95	-
Li	**Ag**	27.64	56.59	65.02	65.23	44.91	121
Li	**Au**	0.09	0.70	0.62	0.75	0.22	156
Li	**Mg**	198.43	501.80	547.62	571.21	339.12	22
Na	**Li**	-19.00	-36.29	-39.20	-40.34	-27.19	-1
Li	**Cd**	111.61	239.69	275.47	277.15	185.69	41
Na	**K**	7.41	13.76	15.03	15.34	10.66	29
Na	**Rb**	6.96	12.91	14.10	14.40	10.00	-
Na	**Cs**	94.38	129.26	136.63	135.37	123.20	-
Na	**Cu**	179.62	408.34	462.13	470.20	302.99	-
Na	**Ag**	50.28	89.60	108.60	105.04	80.22	-
Na	**Au**	54.91	100.82	121.11	117.92	88.16	-
K	**Li**	345.60	505.11	537.55	536.88	459.24	-
K	**Na**	15.01	32.08	34.49	35.81	22.91	-17
K	**Rb**	42.49	88.97	96.29	99.51	64.80	-
K	**Cs**	39.76	83.37	90.18	93.22	60.64	33
Rb	**Li**	220.30	441.40	487.84	497.97	337.12	-
Rb	**Na**	-4.09	-9.85	-10.29	-10.92	-6.33	-
Rb	**K**	25.73	54.44	58.72	60.82	39.26	-
Rb	**Cs**	25.03	52.99	57.14	59.19	38.20	-
Cs	**Li**	0.45	-3.79	-2.79	-3.91	0.03	-
Cs	**Na**	15.28	25.97	31.04	30.13	23.68	-
Cs	**K**	-0.62	-1.84	-1.90	-2.05	-1.08	-
Cs	**Rb**	201.78	478.82	525.29	544.39	334.78	-
Cu	**Li**	15.99	26.67	29.31	29.56	21.87	-
Cu	**Na**	7.34	12.35	13.48	13.66	9.96	-
Cu	**K**	22.63	37.28	41.26	41.38	31.25	-
Cu	**Rb**	22.20	36.61	40.50	40.64	30.62	-
Cu	**Cs**	54.34	81.75	85.73	86.33	71.63	-
Cu	**Ag**	19.31	32.06	35.34	35.56	26.52	-
Cu	**Au**	19.13	31.77	35.01	35.23	26.26	-
Cu	**Ca**	227.76	371.39	393.71	402.35	296.60	-
Cu	**Ba**	324.22	532.72	572.90	582.27	430.27	-
Cu	**Be**	96.32	133.39	141.22	140.58	123.97	-
Cu	**Mg**	68.18	97.68	99.86	101.64	84.36	-53
Cu	**Zn**	94.46	130.47	138.05	137.40	121.48	-31
Cu	**Cd**	54.84	72.33	73.65	73.98	67.40	-58
Cu	**Hg**	156.34	250.20	262.55	268.80	200.75	-
Cu	**Al**	200.94	273.75	284.71	285.02	252.76	-
Cu	**Ga**	221.08	303.44	317.58	317.42	280.26	-
Cu	**In**	215.66	295.30	308.62	308.54	272.90	-
Cu	**Ge**	579.31	823.81	871.18	872.01	744.97	-
Cu	**Sn**	454.31	629.81	660.19	660.64	577.00	54
Cu	**Sb**	763.88	1063.03	1115.04	1116.28	970.92	-
Ag	**Li**	-5.22	-9.34	-10.28	-10.44	-7.39	-55
Ag	**Na**	-15.40	-27.85	-30.46	-31.05	-21.71	-
Ag	**K**	6.50	11.50	12.75	12.88	9.26	-
Ag	**Rb**	5.55	9.82	10.89	11.01	7.90	-
Ag	**Cs**	29.14	44.60	49.85	48.87	41.80	-
Ag	**Cu**	-21.21	-38.73	-42.19	-43.13	-29.81	-

Ag	**Au**	-0.31	-0.55	-0.61	-0.62	-0.44	30
Ag	**Mg**	69.86	90.48	92.98	92.36	87.85	-47
Ag	**Zn**	224.08	343.29	369.58	370.39	302.01	-
Ag	**Ca**	167.71	279.68	292.99	300.82	222.29	-
Ag	**Ba**	328.26	568.24	607.98	621.88	447.94	-
Ag	**Cd**	94.47	128.12	135.12	133.91	122.36	-
Ag	**Hg**	100.42	155.73	160.08	163.93	129.11	-
Ag	**Al**	383.80	562.79	600.02	599.93	507.69	-
Ag	**Ga**	444.18	662.87	709.07	709.90	591.36	-
Ag	**In**	429.62	638.66	682.72	683.29	571.19	-
Ag	**Ge**	1123.57	1728.83	1854.89	1863.33	1508.42	-
Ag	**Sn**	866.85	1298.82	1388.45	1391.43	1153.62	-
Au	**Li**	-4.89	-8.73	-9.60	-9.75	-6.91	-68
Au	**Na**	-15.08	-27.22	-29.78	-30.35	-21.24	-
Au	**K**	6.74	11.91	13.21	13.34	9.60	-
Au	**Rb**	5.80	10.26	11.37	11.50	8.26	-
Au	**Cs**	29.12	44.44	49.59	48.62	41.70	-
Au	**Cu**	-20.97	-38.22	-41.63	-42.56	-29.44	-
Au	**Ag**	0.31	0.55	0.61	0.61	0.44	-21
Au	**Ca**	169.58	282.76	296.30	304.20	224.70	-
Au	**Ba**	329.46	569.63	609.54	623.39	449.27	-
Au	**Zn**	220.96	337.77	363.53	364.27	297.50	-
Au	**Cd**	93.07	125.86	132.61	131.41	120.37	-
Au	**Hg**	101.70	158.00	162.50	166.44	130.78	-
Au	**Al**	378.94	554.49	590.89	590.74	500.69	-
Au	**Ga**	438.55	653.10	698.34	699.08	583.23	-
Au	**In**	424.16	629.21	672.35	672.84	563.32	-
Au	**Ge**	1111.08	1706.51	1830.45	1838.59	1490.21	-
Au	**Sn**	599.66	870.19	921.62	923.03	784.78	-
Be	**Li**	22.85	30.95	32.02	32.02	28.10	-
Be	**Na**	7.84	10.39	11.16	10.72	11.01	-
Be	**K**	45.28	62.06	63.69	64.42	53.44	-
Be	**Mg**	73.35	107.60	114.42	115.67	86.89	-
Be	**Tl**	124.20	175.33	181.98	185.35	141.75	-
Be	**Pb**	235.67	323.56	332.01	338.45	266.70	-
Mg	**Li**	1.39	5.04	8.61	7.59	5.55	-15
Mg	**Na**	-13.18	-17.86	-16.23	-17.36	-14.03	-
Mg	**K**	15.71	26.94	32.34	31.30	24.81	-
Mg	**Cu**	-24.34	-35.65	-35.48	-36.76	-28.99	157
Mg	**Ag**	7.91	15.11	19.54	18.52	14.33	116
Mg	**Be**	18.83	24.19	27.57	26.18	26.17	-
Mg	**Cd**	-17.03	-30.01	-31.60	-32.75	-22.11	-
Mg	**Al**	86.50	112.04	117.02	115.88	108.81	7
Mg	**In**	99.68	131.57	138.52	137.15	126.69	78
Mg	**Tl**	99.80	131.76	138.73	137.35	126.85	-
Mg	**Sn**	295.13	405.28	426.16	425.23	375.45	-
Mg	**Pb**	263.35	357.47	373.75	373.17	332.51	-
Zn	**Cu**	40.13	64.75	70.88	71.30	53.18	170
Zn	**Al**	116.01	169.79	175.73	179.35	140.50	14
Zn	**Pb**	241.29	342.26	352.74	358.80	291.21	280
Cd	**Li**	29.31	50.09	56.66	56.46	42.08	-18
Cd	**Cu**	1.66	6.93	9.90	9.50	5.16	128
Cd	**Mg**	29.18	49.17	52.15	53.56	37.88	-8
Cd	**Al**	80.37	106.74	110.44	110.44	99.81	-
Cd	**In**	84.49	111.54	116.15	115.66	105.72	59
Al	**Li**	-14.49	-22.94	-23.58	-24.98	-14.67	-
Al	**Na**	-33.04	-49.09	-50.40	-52.25	-36.79	-
Al	**K**	12.28	15.08	15.29	14.70	16.90	-

Al	**Cu**	-44.33	-64.94	-66.77	-68.83	-50.40	-
Al	**Ag**	-3.71	-7.69	-7.98	-9.07	-1.94	-
Al	**Be**	-77.04	-110.89	-114.87	-117.21	-90.56	-19
Al	**Mg**	-21.26	-26.54	-25.31	-26.31	-22.63	-2
Al	**Ca**	71.33	108.29	119.24	118.35	94.12	-
Al	**Zn**	-77.07	-110.91	-114.89	-117.23	-90.61	1
Al	**Cd**	-48.05	-66.70	-68.11	-69.59	-55.58	-
Al	**Ga**	-17.54	-27.13	-28.54	-29.24	-20.83	-
Al	**In**	-14.04	-21.69	-22.83	-23.38	-16.70	103
Al	**Si**	51.80	58.60	59.79	58.32	63.22	-
Al	**Ge**	49.65	57.29	57.80	57.03	59.30	-
Al	**Pb**	107.38	149.26	153.51	156.23	125.80	-
In	**Mg**	25.20	51.08	56.92	58.44	35.27	-53
In	**Cd**	-19.10	-19.18	-17.94	-17.71	-21.41	-47
In	**Al**	-6.06	-11.04	-11.26	-11.96	-7.16	-40
In	**Ga**	-2.15	-3.72	-3.85	-4.03	-2.62	-
In	**Tl**	-0.06	-0.11	-0.11	-0.11	-0.08	-
In	**Sn**	100.28	135.18	139.39	140.25	122.69	72
In	**Pb**	111.66	155.77	160.42	162.54	136.19	147
In	**Bi**	1270.19	1999.12	2109.67	2154.64	1599.11	-
In	**Be**	-173.83	-244.34	-251.54	-255.05	-213.15	-
Sn	**Cu**	-27.88	-38.52	-36.96	-39.19	-28.87	33
Sn	**Mg**	-28.35	-29.64	-26.11	-27.06	-29.14	-
Sn	**Cd**	-69.15	-91.43	-91.94	-93.64	-80.30	-
Sn	**In**	-70.94	-96.67	-99.07	-100.44	-84.49	-54
Sn	**Pb**	24.52	39.15	41.00	42.24	29.60	88
Sn	**Sb**	121.73	165.89	170.38	172.53	145.48	-
Sn	**Bi**	1172.55	1805.15	1911.87	1946.32	1448.75	-
Pb	**Li**	0.72	2.29	6.15	4.05	7.07	-
Pb	**Na**	-20.25	-27.73	-25.24	-27.56	-19.27	-
Pb	**K**	25.75	37.96	42.98	41.32	38.10	-
Pb	**Be**	-115.59	-163.02	-167.89	-170.67	-139.38	-
Pb	**Mg**	-46.75	-57.12	-55.09	-56.36	-52.31	-
Pb	**Zn**	-115.85	-163.43	-168.32	-171.12	-139.72	-132
Pb	**Cd**	-85.06	-116.00	-117.88	-119.94	-100.86	-
Pb	**Hg**	67.02	116.48	130.85	131.25	93.02	-
Pb	**Al**	-74.87	-103.14	-105.85	-107.34	-90.01	-
Pb	**In**	-85.49	-120.23	-123.80	-125.80	-103.10	-109
Pb	**Tl**	-85.55	-120.33	-123.91	-125.91	-103.17	-
Pb	**Sn**	-14.72	-24.67	-25.62	-26.68	-17.67	-50
Pb	**Bi**	1097.23	1712.58	1813.59	1848.75	1370.25	-
Sb	**Mg**	-441.57	-588.51	-587.09	-602.67	-499.30	-
Sb	**Pb**	-355.05	-465.51	-473.43	-478.77	-417.30	-
Bi	**Pb**	-1420.19	-2243.98	-2348.39	-2417.35	-1716.09	-

Table 5. The force on a nearest neighbour to a vacancy (F_{NN}) for dilutes alloys $[10^6 / j\ (amps/cm^2)]$ (in eV/cm).

Dilute Alloys		Present Results					Others
Solute	**Solvent**	**H**	**T**	**IU**	**F**	**S**	**[10, 15]**
Li	**Na**	-0.49	0.11	2.38	1.74	0.89	25
Li	**K**	4.18	8.79	12.46	11.81	7.98	-
Li	**Rb**	3.95	8.38	11.99	11.34	7.64	-
Li	**Cs**	17.29	32.70	38.22	38.11	26.73	-
Li	**Cu**	34.72	60.92	67.12	66.58	53.27	-
Li	**Ag**	40.79	73.31	80.45	80.17	62.92	33
Li	**Au**	27.70	46.66	51.77	50.95	42.13	31
Li	**Mg**	-9.07	-26.74	-27.68	-29.65	-16.02	41
Li	**Cd**	7.54	5.01	3.60	2.81	8.84	25
Na	**Li**	-1.96	-2.66	-0.93	-1.53	-1.40	20
Na	**K**	2.72	6.09	9.37	8.72	5.79	44
Na	**Rb**	2.65	5.97	9.23	8.57	5.69	-
Na	**Cs**	-13.26	-23.09	-23.96	-24.74	-17.83	-
Na	**Cu**	10.52	12.04	9.60	9.52	13.38	-
Na	**Ag**	4.20	-2.78	-3.02	-4.60	3.78	-
Na	**Au**	4.48	-2.12	-2.46	-3.97	4.21	-
K	**Li**	-22.81	-40.30	-43.33	-44.26	-31.66	-
K	**Na**	-0.09	-2.51	-1.33	-2.17	0.23	19
K	**Rb**	-3.41	-8.12	-7.06	-8.02	-4.45	-
K	**Cs**	-3.13	-7.66	-6.58	-7.53	-4.06	92
Rb	**Li**	-16.22	-28.45	-28.26	-29.32	-22.46	-
Rb	**Na**	5.32	6.78	8.11	7.51	7.87	-
Rb	**K**	-1.55	-4.99	-3.86	-4.76	-1.83	-
Rb	**Cs**	-1.47	-4.85	-3.71	-4.60	-1.71	-
Cs	**Li**	19.02	30.00	33.45	32.63	28.37	-
Cs	**Na**	24.04	39.89	43.79	43.24	36.09	-
Cs	**K**	13.80	19.78	22.74	21.66	20.35	-
Cs	**Rb**	-14.84	-34.79	-34.91	-37.07	-23.40	-
Cu	**Li**	2.42	4.81	6.98	6.43	4.86	-
Cu	**Na**	-0.09	0.70	2.53	1.94	1.46	-
Cu	**K**	5.48	9.80	12.29	11.83	8.92	-
Cu	**Rb**	5.21	9.36	11.83	11.35	8.56	-
Cu	**Cs**	19.27	32.02	34.73	35.08	26.33	-
Cu	**Ag**	3.72	6.94	9.26	8.74	6.60	-
Cu	**Au**	3.64	6.81	9.12	8.60	6.49	-
Cu	**Ca**	-2.93	-3.16	0.06	-1.16	-0.87	-
Cu	**Ba**	8.76	16.02	20.80	19.81	14.94	-
Cu	**Be**	-16.34	-25.88	-27.31	-27.80	-21.18	-
Cu	**Mg**	-12.85	-19.74	-19.08	-20.06	-15.22	65
Cu	**Zn**	-16.32	-25.83	-27.23	-27.73	-21.12	87
Cu	**Cd**	-14.36	-22.34	-22.36	-23.20	-17.62	85
Cu	**Hg**	-7.57	-10.85	-8.59	-9.78	-7.40	-
Cu	**Al**	-23.75	-37.41	-38.84	-39.77	-30.27	-
Cu	**Ga**	-24.24	-38.30	-40.15	-40.97	-31.20	-
Cu	**In**	-24.14	-38.11	-39.87	-40.71	-31.00	-
Cu	**Ge**	-33.50	-53.35	-57.32	-57.97	-44.22	-
Cu	**Sn**	-32.75	-51.87	-54.79	-55.76	-42.48	113
Cu	**Sb**	-41.22	-65.38	-69.37	-70.48	-53.71	-
Ag	**Li**	-1.10	-1.11	1.53	0.59	0.55	35
Ag	**Na**	-3.94	-5.96	-3.95	-4.87	-3.57	-
Ag	**K**	2.46	4.97	8.25	7.34	5.62	-
Ag	**Rb**	2.14	4.42	7.65	6.74	5.17	-
Ag	**Cs**	22.73	39.45	44.46	44.40	33.22	-
Ag	**Cu**	-5.80	-9.16	-7.64	-8.52	-6.33	-

Ag	**Au**	0.31	1.29	4.20	3.27	2.56	86
Ag	**Mg**	-22.01	-36.20	-37.07	-38.20	-28.82	53
Ag	**Zn**	-26.31	-43.69	-47.61	-47.98	-36.47	-
Ag	**Ca**	-10.95	-17.19	-13.96	-15.74	-11.68	-
Ag	**Ba**	2.33	5.52	11.65	9.81	7.57	-
Ag	**Cd**	-23.78	-39.27	-41.16	-42.07	-31.81	-
Ag	**Hg**	-16.09	-26.00	-24.36	-25.95	-19.43	-
Ag	**Al**	-38.45	-63.75	-68.65	-69.48	-52.72	-
Ag	**Ga**	-39.12	-64.92	-70.45	-71.11	-54.01	-
Ag	**In**	-38.98	-64.67	-70.05	-70.75	-53.73	-
Ag	**Ge**	-54.04	-89.88	-99.40	-99.66	-75.90	-
Ag	**Sn**	-52.27	-86.85	-94.80	-95.50	-72.55	-
Au	**Li**	-0.73	-0.45	2.23	1.31	1.07	32
Au	**Na**	-3.61	-5.38	-3.33	-4.23	-3.11	-
Au	**K**	2.88	5.70	9.03	8.14	6.20	-
Au	**Rb**	2.55	5.15	8.42	7.53	5.74	-
Au	**Cs**	23.13	40.08	45.10	45.06	33.72	-
Au	**Cu**	-5.52	-8.65	-7.09	-7.96	-5.93	-
Au	**Ag**	0.79	2.14	5.11	4.20	3.24	86
Au	**Ca**	-10.37	-16.14	-12.84	-14.59	-10.85	-
Au	**Ba**	3.14	6.94	13.16	11.35	8.69	-
Au	**Zn**	-26.41	-43.79	-47.68	-48.06	-36.55	-
Au	**Cd**	-23.68	-39.03	-40.87	-41.78	-31.63	-
Au	**Hg**	-15.65	-25.19	-23.48	-25.05	-18.80	-
Au	**Al**	-38.51	-63.73	-68.59	-69.42	-52.72	-
Au	**Ga**	-39.24	-65.01	-70.49	-71.16	-54.09	-
Au	**In**	-39.08	-64.73	-70.07	-70.78	-53.79	-
Au	**Ge**	-54.41	-90.37	-99.85	-100.13	-76.29	-
Au	**Sn**	85.59	133.03	142.62	142.70	118.01	-
Be	**Li**	-10.17	-14.06	-14.83	-14.93	-11.96	-
Be	**Na**	-14.98	-21.18	-22.23	-22.53	-17.36	-
Be	**K**	-4.20	-5.23	-5.61	-5.49	-5.23	-
Be	**Mg**	-42.84	-62.11	-64.82	-66.20	-48.65	-
Be	**Tl**	-45.52	-67.05	-69.87	-71.65	-51.06	-
Be	**Pb**	-89.47	-129.79	-135.46	-138.37	-101.58	-
Mg	**Li**	-38.78	-64.59	-68.70	-70.35	-50.69	13
Mg	**Na**	-35.50	-59.81	-63.59	-65.24	-46.41	-
Mg	**K**	-40.46	-66.63	-70.92	-72.48	-52.88	-
Mg	**Cu**	-32.01	-54.53	-57.97	-59.56	-41.88	61
Mg	**Ag**	-39.77	-65.91	-70.13	-71.75	-51.98	59
Mg	**Be**	19.60	23.42	24.38	23.71	24.90	-
Mg	**Cd**	-10.37	-24.53	-26.33	-28.02	-14.01	-
Mg	**Al**	13.77	10.08	10.08	8.54	17.06	48
Mg	**In**	20.95	21.58	22.24	20.95	26.38	139
Mg	**Tl**	21.00	21.67	22.34	21.04	26.45	-
Mg	**Sn**	40.72	49.29	51.35	50.06	51.77	-
Mg	**Pb**	30.42	32.77	33.89	32.24	38.41	-
Zn	**Cu**	-23.49	-36.14	-37.84	-38.67	-29.00	60
Zn	**Al**	-2.35	-9.87	-10.23	-11.75	-1.71	48
Zn	**Pb**	5.54	-0.30	-0.20	-2.01	8.50	93
Cd	**Li**	-35.86	-58.04	-61.09	-62.58	-46.07	56
Cd	**Cu**	-30.38	-50.25	-52.79	-54.30	-38.95	58
Cd	**Mg**	-24.66	-45.22	-47.37	-49.52	-31.42	39
Cd	**Al**	9.13	4.23	4.55	2.79	12.06	-
Cd	**In**	15.91	14.88	15.71	14.18	20.76	65
Al	**Li**	-21.82	-32.43	-34.83	-35.09	-26.94	-
Al	**Na**	-19.50	-29.61	-32.12	-32.34	-24.25	-
Al	**K**	-23.25	-33.81	-35.95	-36.23	-28.51	-

Al	**Cu**	-17.20	-26.63	-29.12	-29.32	-21.53	-
Al	**Ag**	-22.59	-33.26	-35.57	-35.84	-27.81	-
Al	**Be**	14.67	15.88	14.68	14.75	16.78	15
Al	**Mg**	-9.85	-19.36	-22.94	-23.06	-13.38	51
Al	**Ca**	-35.32	-54.47	-59.47	-59.88	-44.16	-
Al	**Zn**	14.34	15.39	14.15	14.22	16.36	50
Al	**Cd**	-2.12	-8.35	-11.26	-11.31	-3.92	-
Al	**Ga**	18.52	18.74	16.56	16.64	20.84	-
Al	**In**	17.35	17.05	14.74	14.81	19.40	74
Al	**Si**	49.16	60.64	60.52	60.76	58.11	-
Al	**Ge**	43.14	51.84	51.01	51.22	50.64	-
Al	**Pb**	24.51	24.73	21.81	21.91	27.57	-
In	**Mg**	19.87	21.87	20.85	20.66	23.36	58
In	**Cd**	27.32	32.51	32.10	31.97	32.78	9
In	**Al**	64.42	82.53	84.06	84.02	78.91	23
In	**Ga**	60.78	77.26	78.45	78.38	74.28	-
In	**Tl**	59.78	75.80	76.89	76.81	73.00	-
In	**Sn**	85.90	110.04	112.09	112.02	105.21	101
In	**Pb**	80.89	102.79	104.35	104.26	98.85	104
In	**Bi**	31.22	28.52	24.52	23.95	35.09	-
In	**Be**	155.92	203.60	207.66	208.30	190.94	-
Sn	**Cu**	-33.72	-52.15	-55.43	-56.41	-41.74	118
Sn	**Mg**	-29.20	-51.19	-55.20	-56.96	-35.98	-
Sn	**Cd**	-15.09	-30.89	-33.85	-35.41	-18.53	-
Sn	**In**	17.51	12.06	10.65	9.01	21.81	125
Sn	**Pb**	26.16	20.18	18.53	16.39	32.54	178
Sn	**Sb**	55.81	59.08	58.79	56.56	69.21	-
Sn	**Bi**	-104.32	-172.56	-184.83	-189.59	-128.77	-
Pb	**Li**	15.88	23.29	23.50	24.24	18.77	-
Pb	**Na**	22.43	32.37	32.74	33.64	26.64	-
Pb	**K**	7.34	11.30	11.32	11.82	8.53	-
Pb	**Be**	67.21	89.71	91.23	92.34	80.37	-
Pb	**Mg**	69.69	96.68	98.10	100.00	83.21	-
Pb	**Zn**	67.32	89.93	91.45	92.57	80.51	57
Pb	**Cd**	70.32	96.54	98.02	99.72	84.00	-
Pb	**Hg**	61.74	87.41	88.57	90.64	73.58	-
Pb	**Al**	103.32	139.41	141.69	143.69	123.51	-
Pb	**In**	102.27	137.34	139.62	141.47	122.28	84
Pb	**Tl**	102.27	137.32	139.60	141.45	122.27	-
Pb	**Sn**	134.13	178.90	181.94	184.11	160.41	118
Pb	**Bi**	168.89	236.39	239.72	244.78	201.51	-
Sb	**Mg**	10.85	-25.89	-43.19	-44.64	4.76	-
Sb	**Pb**	353.59	415.28	407.68	406.99	418.78	-
Bi	**Pb**	0.16	-97.49	-141.16	-144.51	-24.89	-

Table 6. κ_{INT} for dilutes alloys (in $10^{-6}\ \Omega - cm$).

Dilute Alloys		Present Results					Others	Expt.
Solute	Solvent	H	T	IU	F	S	[10]	[10]
Li	Na	121.53	214.72	227.65	233.85	167.44	93	-
Li	K	152.02	271.59	289.65	297.25	211.25	-	-
Li	Rb	151.01	269.69	287.56	295.11	209.78	-	-
Li	Cs	137.72	249.59	270.55	276.50	194.65	-	-
Li	Cu	95.76	161.81	171.55	173.02	137.39	-	-
Li	Ag	94.84	154.77	165.38	165.55	135.11	231	-
Li	Au	96.27	168.69	177.37	180.28	139.13	278	-
Li	Mg	86.50	176.77	179.18	188.21	128.51	46	-
Li	Cd	30.24	14.35	3.05	1.91	27.32	57	-
Na	Li	107.23	188.24	199.02	204.52	147.08	49	-
Na	K	144.68	257.82	274.54	281.82	200.63	128	15
Na	Rb	144.31	257.12	273.76	281.03	200.09	-	-
Na	Cs	82.26	132.89	136.02	140.22	106.94	-	-
Na	Cu	-1.89	-73.57	-91.51	-97.77	-29.45	-	-
Na	Ag	66.50	113.74	110.08	114.70	91.48	-	-
Na	Au	63.38	105.18	100.85	104.98	85.95	-	-
K	Li	65.57	93.08	90.10	93.34	78.79	-	-
K	Na	87.74	158.66	166.14	171.10	123.90	63	23
K	Rb	96.37	178.46	187.30	193.28	137.29	-	-
K	Cs	95.70	176.91	185.63	191.54	136.25	71	-
Rb	Li	102.85	204.41	216.53	224.65	150.36	-	-
Rb	Na	71.05	121.44	126.54	129.66	98.30	-	-
Rb	K	91.72	167.72	175.81	181.23	130.06	-	-
Rb	Cs	91.49	167.19	175.25	180.65	129.70	-	-
Cs	Li	86.86	151.57	158.29	161.52	124.04	-	-
Cs	Na	78.82	129.05	134.89	136.44	110.31	-	-
Cs	K	94.53	173.46	181.04	185.95	137.23	-	-
Cs	Rb	118.41	254.24	265.04	277.35	181.25	-	-
Cu	Li	120.44	197.08	209.60	214.01	157.48	-	-
Cu	Na	116.01	189.36	200.90	205.26	151.23	-	-
Cu	K	119.79	196.47	209.56	213.78	157.16	-	-
Cu	Rb	120.08	196.91	209.98	214.22	157.49	-	-
Cu	Cs	36.82	61.39	68.69	68.90	50.83	-	-
Cu	Ag	120.89	198.03	210.87	215.22	158.30	-	-
Cu	Au	120.89	198.02	210.85	215.20	158.29	-	-
Cu	Ca	222.25	362.10	383.59	392.08	289.16	-	-
Cu	Ba	241.39	395.62	421.53	430.15	316.32	-	-
Cu	Be	31.60	43.71	42.81	44.34	36.61	-	-
Cu	Mg	133.09	212.66	222.91	228.34	170.42	57	-
Cu	Zn	33.07	46.14	45.40	46.99	38.54	100	-
Cu	Cd	102.26	161.27	168.04	172.31	129.69	70	-
Cu	Hg	194.76	315.78	333.47	341.10	252.27	-	-
Cu	Al	84.57	127.35	129.98	133.73	103.83	-	-
Cu	Ga	62.52	90.68	90.95	93.84	74.80	-	-
Cu	In	67.53	99.02	99.82	102.91	81.40	-	-
Cu	Ge	2.71	-13.13	-21.28	-20.62	-6.32	-	-
Cu	Sn	59.58	81.37	79.20	82.12	68.45	87	48, 114
Cu	Sb	56.56	71.95	67.35	70.28	62.01	-	-
Ag	Li	150.93	260.65	278.09	284.69	205.24	63	-
Ag	Na	135.72	233.72	248.73	254.81	183.93	-	-
Ag	K	162.41	281.10	300.70	307.60	221.56	-	-
Ag	Rb	161.66	279.77	299.21	306.09	220.49	-	-
Ag	Cs	121.85	211.97	231.04	234.78	169.40	-	-
Ag	Cu	121.72	208.99	221.92	227.48	164.43	-	-

Ag	**Au**	156.35	270.29	288.70	295.45	212.91	300	-
Ag	**Mg**	104.52	173.45	180.46	185.88	136.76	50	-
Ag	**Zn**	-27.06	-57.72	-67.28	-67.63	-44.28	-	-
Ag	**Ca**	248.94	427.71	454.36	465.70	336.51	-	-
Ag	**Ba**	318.15	550.29	588.13	601.78	433.57	-	-
Ag	**Cd**	62.22	99.09	100.69	104.28	78.50	-	-
Ag	**Hg**	198.11	338.11	357.56	366.90	266.00	-	-
Ag	**Al**	3.48	-9.18	-18.07	-16.64	-5.85	-	-
Ag	**Ga**	-24.42	-58.18	-70.52	-70.33	-44.19	-	-
Ag	**In**	-18.11	-47.09	-58.66	-58.18	-35.52	-	-
Ag	**Ge**	-132.30	-252.66	-281.36	-285.58	-195.92	-	-
Ag	**Sn**	-61.30	-128.21	-148.21	-149.28	-98.42	-	-
Au	**Li**	151.09	260.60	278.04	284.61	205.29	63	-
Au	**Na**	136.05	234.00	249.03	255.10	184.22	-	-
Au	**K**	162.35	280.64	300.20	307.06	221.30	-	-
Au	**Rb**	161.63	279.34	298.75	305.59	220.25	-	-
Au	**Cs**	120.44	209.23	228.10	231.75	167.34	-	-
Au	**Cu**	122.15	209.49	222.44	228.00	164.88	-	-
Au	**Ag**	156.74	270.62	289.07	295.80	213.27	250	-
Au	**Ca**	249.77	428.62	455.34	466.66	337.37	-	-
Au	**Ba**	318.21	549.67	587.46	601.04	433.27	-	-
Au	**Zn**	-25.77	-55.31	-64.66	-64.95	-42.43	-	-
Au	**Cd**	63.54	101.33	103.10	106.75	80.26	-	-
Au	**Hg**	199.19	339.58	359.15	368.50	267.26	-	-
Au	**Al**	5.45	-5.63	-14.22	-12.69	-3.09	-	-
Au	**Ga**	-22.47	-54.58	-66.62	-66.33	-41.43	-	-
Au	**In**	-16.15	-43.51	-54.77	-54.20	-32.75	-	-
Au	**Ge**	-129.81	-247.81	-276.08	-280.15	-192.24	-	-
Au	**Sn**	198.26	287.43	304.32	304.78	259.34	-	-
Be	**Li**	11.32	16.85	18.25	18.41	13.33	-	-
Be	**Na**	21.71	31.56	33.46	33.93	25.15	-	-
Be	**K**	-1.24	-1.01	-0.27	-0.47	-1.01	-	-
Be	**Mg**	82.20	116.78	121.57	123.79	93.96	-	-
Be	**Tl**	106.27	148.82	154.04	156.90	121.04	-	-
Be	**Pb**	174.98	248.98	259.42	264.09	200.31	-	-
Mg	**Li**	67.01	108.25	113.97	116.76	86.08	72	-
Mg	**Na**	68.11	109.29	114.79	117.59	87.27	-	-
Mg	**K**	62.44	101.59	107.30	109.92	80.43	-	-
Mg	**Cu**	67.12	107.11	112.31	115.03	85.84	324	-
Mg	**Ag**	65.46	106.07	111.82	114.56	84.19	284	-
Mg	**Be**	53.59	75.05	76.70	77.87	65.86	-	-
Mg	**Cd**	87.59	132.71	137.60	140.52	110.16	-	-
Mg	**Al**	98.62	143.41	147.59	150.27	122.52	41	-
Mg	**In**	90.30	129.34	132.73	134.99	111.69	80	-
Mg	**Tl**	90.24	129.23	132.61	134.87	111.60	-	-
Mg	**Sn**	105.38	147.07	150.20	152.44	129.37	-	-
Mg	**Pb**	117.49	167.53	171.78	174.64	145.13	-	-
Zn	**Cu**	29.43	44.15	45.73	46.93	35.32	377	-
Zn	**Al**	88.24	124.79	128.55	130.72	106.44	48	-
Zn	**Pb**	113.26	159.01	163.71	166.30	136.63	136	-
Cd	**Li**	50.42	80.37	84.26	86.42	63.82	74	-
Cd	**Cu**	53.82	84.57	88.33	90.51	67.92	332	-
Cd	**Mg**	90.45	137.22	142.43	145.52	113.27	59	-
Cd	**Al**	98.62	142.38	146.79	149.25	122.19	-	-
Cd	**In**	92.64	132.25	136.14	138.26	114.51	82	-
Al	**Li**	27.39	41.13	43.61	44.37	32.76	-	-
Al	**Na**	36.03	53.63	56.48	57.54	42.91	-	-
Al	**K**	15.56	23.88	25.77	26.14	18.82	-	-

Al	**Cu**	40.93	60.64	63.65	64.88	48.64	-	-
Al	**Ag**	22.48	33.99	36.23	36.83	26.98	-	-
Al	**Be**	65.40	92.80	95.87	97.71	76.80	47	-
Al	**Mg**	90.82	132.36	137.77	140.54	107.28	73	-
Al	**Ca**	80.27	119.01	124.97	127.38	95.41	-	-
Al	**Zn**	65.91	93.58	96.69	98.54	77.40	72	51
Al	**Cd**	85.51	123.87	128.67	131.25	100.85	-	-
Al	**Ga**	103.22	147.04	152.05	155.00	121.30	-	-
Al	**In**	104.87	149.56	154.71	157.72	123.26	102	-
Al	**Si**	97.86	135.35	139.00	141.46	114.39	-	-
Al	**Ge**	108.53	151.59	156.03	158.88	127.08	-	-
Al	**Pb**	137.88	196.44	203.14	207.08	162.04	-	-
In	**Mg**	68.42	100.29	103.51	105.69	83.46	63	-
In	**Cd**	65.72	95.16	98.16	100.04	80.18	77	-
In	**Al**	83.29	116.11	119.56	121.13	101.57	45	-
In	**Ga**	86.23	121.12	124.76	126.55	105.17	-	-
In	**Tl**	87.01	122.45	126.14	127.99	106.12	-	-
In	**Sn**	111.06	154.81	159.41	161.51	135.43	96	-
In	**Pb**	115.09	161.70	166.56	168.96	140.37	129	-
In	**Bi**	173.92	257.48	265.91	271.95	212.06	-	-
In	**Be**	169.64	235.78	243.05	245.79	208.41	-	-
Sn	**Cu**	30.55	45.59	47.39	48.56	36.41	387	-
Sn	**Mg**	70.50	102.54	106.04	108.31	84.22	-	-
Sn	**Cd**	67.89	97.83	101.05	103.09	81.12	-	-
Sn	**In**	88.86	125.22	128.99	131.24	106.15	95	-
Sn	**Pb**	117.37	165.16	170.11	173.04	140.21	140	-
Sn	**Sb**	137.08	190.88	196.39	199.50	163.73	-	-
Sn	**Bi**	177.65	260.37	269.60	275.62	212.18	-	-
Pb	**Li**	24.46	37.54	39.20	40.26	29.43	-	-
Pb	**Na**	30.29	45.96	47.85	49.08	36.53	-	-
Pb	**K**	16.11	25.25	26.54	27.34	19.24	-	-
Pb	**Be**	56.14	78.76	81.08	82.36	67.71	-	-
Pb	**Mg**	72.06	105.63	109.27	111.61	87.05	-	-
Pb	**Zn**	56.45	79.26	81.61	82.90	68.08	65	30
Pb	**Cd**	68.61	99.52	102.81	104.88	82.86	-	-
Pb	**Hg**	72.30	108.00	112.04	114.70	87.34	-	-
Pb	**Al**	91.65	130.36	134.39	136.75	110.59	-	-
Pb	**In**	88.34	124.91	128.69	130.86	106.58	92	-
Pb	**Tl**	88.32	124.87	128.65	130.81	106.55	-	-
Pb	**Sn**	111.52	156.26	160.86	163.36	134.48	101	-
Pb	**Bi**	184.01	272.06	281.76	288.10	222.33	-	-
Sb	**Mg**	335.28	484.94	501.82	512.48	396.62	-	-
Sb	**Pb**	565.04	793.79	817.81	832.40	668.61	-	-
Bi	**Pb**	754.20	1113.85	1155.04	1180.74	907.63	-	-

Table 7. κ_{VAC} for dilutes alloys (in $10^{-6}\ \Omega - cm$).

Dilute Alloys		Present Results					Others	Expt.
Solute	**Solvent**	**H**	**T**	**IU**	**F**	**S**	**[10]**	**[10]**
Li	**Na**	123.69	227.40	242.01	249.13	173.74	55	-
Li	**K**	160.56	294.80	315.25	323.97	226.16	-	-
Li	**Rb**	159.31	292.51	312.74	321.41	224.37	-	-
Li	**Cs**	150.66	277.21	300.91	307.75	214.70	-	-
Li	**Cu**	42.71	91.84	99.33	101.22	70.65	-	-
Li	**Ag**	38.50	78.76	86.88	87.31	63.57	185	-
Li	**Au**	47.03	105.66	112.38	115.90	77.95	234	-
Li	**Mg**	57.85	149.70	151.67	162.08	96.87	25	-
Li	**Cd**	-22.44	-60.52	-75.64	-76.80	-40.81	35	-
Na	**Li**	106.69	196.37	208.51	214.83	149.70	17	-
Na	**K**	151.55	278.32	297.24	305.60	213.29	77	15
Na	**Rb**	151.09	277.48	296.32	304.66	212.64	-	-
Na	**Cs**	57.88	109.07	112.26	117.12	80.29	-	-
Na	**Cu**	-60.96	-163.82	-186.79	-193.79	-108.19	-	-
Na	**Ag**	21.15	56.44	50.33	55.75	35.51	-	-
Na	**Au**	17.39	46.36	39.46	44.32	28.93	-	-
K	**Li**	19.20	40.33	36.35	40.13	25.38	-	-
K	**Na**	69.63	142.54	150.28	156.01	104.42	21	23
K	**Rb**	82.52	169.59	179.12	186.01	123.77	-	-
K	**Cs**	81.49	167.42	176.81	183.61	122.23	82	-
Rb	**Li**	106.83	223.51	237.98	247.29	161.05	-	-
Rb	**Na**	46.12	93.54	98.19	101.82	69.24	-	-
Rb	**K**	75.48	154.79	163.33	169.58	113.19	-	-
Rb	**Cs**	75.14	154.08	162.57	168.79	112.68	-	-
Cs	**Li**	44.57	99.04	104.23	108.06	72.28	-	-
Cs	**Na**	32.49	68.81	72.67	74.59	52.55	-	-
Cs	**K**	56.46	128.92	135.42	141.16	91.70	-	-
Cs	**Rb**	103.97	252.41	264.63	278.75	170.06	-	-
Cu	**Li**	128.77	214.49	228.65	233.66	169.72	-	-
Cu	**Na**	123.08	204.98	218.04	223.00	161.89	-	-
Cu	**K**	128.83	214.70	229.49	234.28	170.25	-	-
Cu	**Rb**	129.09	215.12	229.88	234.71	170.55	-	-
Cu	**Cs**	39.41	66.74	74.82	75.08	54.92	-	-
Cu	**Ag**	129.62	215.95	230.47	235.42	171.03	-	-
Cu	**Au**	129.61	215.92	230.42	235.37	171.00	-	-
Cu	**Ca**	234.30	390.23	414.57	424.21	307.82	-	-
Cu	**Ba**	259.15	431.79	461.08	470.88	342.14	-	-
Cu	**Be**	12.78	23.14	22.03	23.77	15.48	-	-
Cu	**Mg**	129.88	217.01	228.60	234.77	169.46	18	-
Cu	**Zn**	14.46	25.92	25.00	26.80	17.69	53	-
Cu	**Cd**	94.21	157.94	165.56	170.41	122.49	29	-
Cu	**Hg**	201.72	336.12	356.17	364.83	264.42	-	-
Cu	**Al**	61.94	105.49	108.36	112.62	79.38	-	-
Cu	**Ga**	36.56	63.48	63.65	66.94	46.04	-	-
Cu	**In**	42.33	73.03	73.82	77.32	53.62	-	-
Cu	**Ge**	-43.99	-68.81	-78.28	-77.52	-60.31	-	-
Cu	**Sn**	21.38	39.36	36.71	40.03	25.47	53	48, 114
Cu	**Sb**	6.14	15.12	9.65	13.00	4.81	-	-
Ag	**Li**	161.04	283.93	303.74	311.24	221.23	17	-
Ag	**Na**	143.38	253.00	270.06	276.98	196.65	-	-
Ag	**K**	174.56	307.62	329.84	337.68	240.25	-	-
Ag	**Rb**	173.67	306.06	328.11	335.93	238.99	-	-
Ag	**Cs**	131.88	232.50	253.85	258.13	184.55	-	-
Ag	**Cu**	127.21	224.69	239.40	245.72	174.25	-	-

Ag	**Au**	167.39	295.06	315.95	323.63	230.13	225	-
Ag	**Mg**	95.10	170.33	178.42	184.58	128.90	15	-
Ag	**Zn**	-55.20	-92.82	-103.56	-103.96	-77.44	-	-
Ag	**Ca**	260.78	460.50	490.83	503.71	357.29	-	-
Ag	**Ba**	341.21	601.38	644.30	659.82	469.30	-	-
Ag	**Cd**	46.74	85.65	87.59	91.67	62.44	-	-
Ag	**Hg**	202.32	358.09	380.29	390.90	276.52	-	-
Ag	**Al**	-32.50	-51.17	-61.09	-59.45	-47.18	-	-
Ag	**Ga**	-64.34	-106.92	-120.77	-120.54	-90.86	-	-
Ag	**In**	-57.14	-94.31	-107.27	-106.72	-80.97	-	-
Ag	**Ge**	-199.56	-341.74	-374.13	-378.90	-277.14	-	-
Ag	**Sn**	-118.97	-200.71	-223.23	-224.43	-166.62	-	-
Au	**Li**	161.27	283.93	303.73	311.20	221.33	19	-
Au	**Na**	143.80	253.38	270.46	277.36	197.04	-	-
Au	**K**	174.53	307.13	329.31	337.10	239.99	-	-
Au	**Rb**	173.67	305.62	327.62	335.40	238.76	-	-
Au	**Cs**	130.28	229.37	250.47	254.65	182.19	-	-
Au	**Cu**	127.76	225.31	240.06	246.38	174.83	-	-
Au	**Ag**	167.88	295.50	316.42	324.08	230.60	174	-
Au	**Ca**	261.82	461.66	492.06	504.92	358.38	-	-
Au	**Ba**	341.34	600.75	643.61	659.05	469.04	-	-
Au	**Zn**	-53.60	-89.90	-100.40	-100.72	-75.18	-	-
Au	**Cd**	48.37	88.37	90.51	94.65	64.61	-	-
Au	**Hg**	203.65	359.92	382.24	392.86	278.08	-	-
Au	**Al**	-30.06	-46.86	-56.42	-54.69	-43.80	-	-
Au	**Ga**	-61.93	-102.56	-116.05	-115.71	-87.46	-	-
Au	**In**	-54.72	-89.96	-102.56	-101.91	-77.58	-	-
Au	**Ge**	-196.46	-335.85	-367.73	-372.34	-272.61	-	-
Au	**Sn**	91.12	153.14	166.98	167.65	130.15	-	-
Be	**Li**	12.15	18.58	20.17	20.36	14.53	-	-
Be	**Na**	21.96	32.64	34.73	35.23	25.70	-	-
Be	**K**	0.11	1.26	2.15	1.98	0.76	-	-
Be	**Mg**	77.13	112.07	117.17	119.40	88.71	-	-
Be	**Tl**	93.31	134.82	140.23	143.08	106.93	-	-
Be	**Pb**	165.87	241.00	252.15	256.84	191.03	-	-
Mg	**Li**	61.38	102.16	108.12	110.86	80.03	43	-
Mg	**Na**	61.54	101.97	107.66	110.40	80.09	-	-
Mg	**K**	57.90	96.95	102.93	105.51	75.70	-	-
Mg	**Cu**	59.89	98.92	104.27	106.93	77.85	286	-
Mg	**Ag**	60.29	100.60	106.60	109.30	78.70	243	-
Mg	**Be**	32.16	49.48	50.78	51.91	41.23	-	-
Mg	**Cd**	67.87	109.37	114.12	116.97	87.67	-	-
Mg	**Al**	67.29	106.11	109.88	112.48	86.60	25	-
Mg	**In**	58.59	91.54	94.47	96.66	75.28	60	-
Mg	**Tl**	58.52	91.42	94.35	96.54	75.20	-	-
Mg	**Sn**	62.44	95.82	98.25	100.41	80.01	-	-
Mg	**Pb**	75.07	116.96	120.58	123.35	96.43	-	-
Zn	**Cu**	24.52	38.84	40.48	41.68	29.96	351	-
Zn	**Al**	61.91	94.31	97.84	100.02	76.61	24	-
Zn	**Pb**	77.25	117.21	121.58	124.17	95.77	121	-
Cd	**Li**	45.96	76.17	80.32	82.50	59.22	51	-
Cd	**Cu**	47.55	78.02	81.97	84.17	61.15	307	-
Cd	**Mg**	72.17	116.44	121.67	124.77	92.68	41	-
Cd	**Al**	66.23	104.37	108.41	110.88	85.12	-	-
Cd	**In**	59.60	93.35	96.81	98.94	76.63	66	-
Al	**Li**	24.43	37.62	40.06	40.79	29.52	-	-
Al	**Na**	32.26	49.04	51.82	52.83	38.73	-	-
Al	**K**	13.61	21.72	23.59	23.95	16.74	-	-

Al	**Cu**	36.62	55.35	58.27	59.44	43.84	-	-
Al	**Ag**	19.95	31.05	33.26	33.84	24.23	-	-
Al	**Be**	53.80	78.90	81.79	83.53	63.85	33	-
Al	**Mg**	79.56	118.50	123.71	126.33	94.67	53	-
Al	**Ca**	71.83	108.67	114.48	116.76	86.03	-	-
Al	**Zn**	54.30	79.66	82.59	84.34	64.44	56	51
Al	**Cd**	73.96	109.75	114.36	116.79	87.93	-	-
Al	**Ga**	85.77	126.05	130.79	133.58	101.81	-	-
Al	**In**	87.41	128.54	133.41	136.25	103.75	85	-
Al	**Si**	75.18	108.61	111.95	114.27	89.11	-	-
Al	**Ge**	85.65	124.46	128.58	131.27	101.55	-	-
Al	**Pb**	114.61	168.45	174.79	178.51	136.04	-	-
In	**Mg**	53.47	82.09	85.05	87.11	66.44	45	-
In	**Cd**	50.89	77.36	80.15	81.92	63.39	60	-
In	**Al**	61.97	91.42	94.72	96.20	77.74	31	-
In	**Ga**	64.72	96.06	99.52	101.21	81.08	-	-
In	**Tl**	65.45	97.29	100.79	102.54	81.96	-	-
In	**Sn**	82.62	121.89	126.29	128.27	103.66	81	-
In	**Pb**	86.41	128.27	132.89	135.15	108.24	113	-
In	**Bi**	136.51	211.42	219.11	224.79	169.29	-	-
In	**Be**	130.60	191.53	198.69	201.29	165.29	-	-
Sn	**Cu**	25.09	39.06	40.81	41.92	30.29	325	-
Sn	**Mg**	56.56	85.91	89.28	91.44	68.53	-	-
Sn	**Cd**	53.46	80.69	83.76	85.71	64.86	-	-
Sn	**In**	66.34	98.73	102.29	104.42	80.81	61	-
Sn	**Pb**	87.30	129.81	134.47	137.26	106.37	105	-
Sn	**Sb**	99.20	146.53	151.67	154.63	121.12	-	-
Sn	**Bi**	144.36	220.53	229.42	235.17	174.70	-	-
Pb	**Li**	19.56	31.29	32.74	33.77	23.73	-	-
Pb	**Na**	25.20	39.53	41.21	42.40	30.65	-	-
Pb	**K**	11.52	19.39	20.47	21.24	13.89	-	-
Pb	**Be**	47.32	68.86	71.11	72.36	58.09	-	-
Pb	**Mg**	62.11	93.68	97.07	99.35	75.87	-	-
Pb	**Zn**	47.61	69.33	71.60	72.87	58.44	50	30
Pb	**Cd**	58.96	88.14	91.24	93.25	72.11	-	-
Pb	**Hg**	61.96	95.18	98.86	101.44	75.53	-	-
Pb	**Al**	77.96	114.69	118.56	120.86	95.54	-	-
Pb	**In**	74.86	109.61	113.26	115.37	91.81	77	-
Pb	**Tl**	74.84	109.57	113.22	115.33	91.78	-	-
Pb	**Sn**	93.93	136.53	141.00	143.45	115.31	86	-
Pb	**Bi**	158.59	241.06	250.01	256.17	193.55	-	-
Sb	**Mg**	275.02	411.50	427.29	437.34	328.76	-	-
Sb	**Pb**	443.71	650.16	672.64	686.41	532.95	-	-
Bi	**Pb**	622.68	951.40	989.93	1014.16	758.22	-	-

Table 8. κ_{SUB} for dilutes alloys (in $10^{-6}\ \Omega - cm$).

Dilute Alloys		Present Results					Expt. [10]
Solute	**Solvent**	**H**	**T**	**IU**	**F**	**S**	
Li	**Na**	-12.87	-24.27	-26.31	-27.00	-18.43	-
Li	**K**	17.51	32.33	35.41	36.09	25.22	-
Li	**Rb**	15.97	29.50	32.29	32.93	22.98	-
Li	**Cs**	65.32	112.23	125.91	125.77	95.39	-
Li	**Cu**	7.00	11.67	14.34	13.75	10.95	-
Li	**Ag**	27.64	56.59	65.02	65.23	44.91	-
Li	**Au**	0.09	0.70	0.62	0.75	0.22	-
Li	**Mg**	198.43	501.80	547.62	571.21	339.12	-
Li	**Cd**	111.61	239.69	275.47	277.15	185.69	-
Na	**Li**	-19.00	-36.29	-39.20	-40.34	-27.19	-
Na	**K**	7.41	13.76	15.03	15.34	10.66	15
Na	**Rb**	6.96	12.91	14.10	14.40	10.00	-
Na	**Cs**	94.38	129.26	136.63	135.37	123.20	-
Na	**Cu**	179.62	408.34	462.13	470.20	302.99	-
Na	**Ag**	50.28	89.60	108.60	105.04	80.22	-
Na	**Au**	54.91	100.82	121.11	117.92	88.16	-
K	**Li**	345.60	505.11	537.55	536.88	459.24	-
K	**Na**	15.01	32.08	34.49	35.81	22.91	23
K	**Rb**	42.49	88.97	96.29	99.51	64.80	-
K	**Cs**	39.76	83.37	90.18	93.22	60.64	-
Rb	**Li**	220.30	441.40	487.84	497.97	337.12	-
Rb	**Na**	-4.09	-9.85	-10.29	-10.92	-6.33	-
Rb	**K**	25.73	54.44	58.72	60.82	39.26	-
Rb	**Cs**	25.03	52.99	57.14	59.19	38.20	-
Cs	**Li**	0.45	-3.79	-2.79	-3.91	0.03	-
Cs	**Na**	15.28	25.97	31.04	30.13	23.68	-
Cs	**K**	-0.62	-1.84	-1.90	-2.05	-1.08	-
Cs	**Rb**	201.78	478.82	525.29	544.39	334.78	-
Cu	**Li**	15.99	26.67	29.31	29.56	21.87	-
Cu	**Na**	7.34	12.35	13.48	13.66	9.96	-
Cu	**K**	22.63	37.28	41.26	41.38	31.25	-
Cu	**Rb**	22.20	36.61	40.50	40.64	30.62	-
Cu	**Cs**	54.34	81.75	85.73	86.33	71.63	-
Cu	**Ag**	19.31	32.06	35.34	35.56	26.52	-
Cu	**Au**	19.13	31.77	35.01	35.23	26.26	-
Cu	**Ca**	227.76	371.39	393.71	402.35	296.60	-
Cu	**Ba**	324.22	532.72	572.90	582.27	430.27	-
Cu	**Be**	96.32	133.39	141.22	140.58	123.97	-
Cu	**Mg**	68.18	97.68	99.86	101.64	84.36	-
Cu	**Zn**	94.46	130.47	138.05	137.40	121.48	-
Cu	**Cd**	54.84	72.33	73.65	73.98	67.40	-
Cu	**Hg**	156.34	250.20	262.55	268.80	200.75	-
Cu	**Al**	200.94	273.75	284.71	285.02	252.76	-
Cu	**Ga**	221.08	303.44	317.58	317.42	280.26	-
Cu	**In**	215.66	295.30	308.62	308.54	272.90	-
Cu	**Ge**	579.31	823.81	871.18	872.01	744.97	-
Cu	**Sn**	454.31	629.81	660.19	660.64	577.00	48, 114
Cu	**Sb**	763.88	1063.03	1115.04	1116.28	970.92	-
Ag	**Li**	-5.22	-9.34	-10.28	-10.44	-7.39	-
Ag	**Na**	-15.40	-27.85	-30.46	-31.05	-21.71	-
Ag	**K**	6.50	11.50	12.75	12.88	9.26	-
Ag	**Rb**	5.55	9.82	10.89	11.01	7.90	-
Ag	**Cs**	29.14	44.60	49.85	48.87	41.80	-
Ag	**Cu**	-21.21	-38.73	-42.19	-43.13	-29.81	-

Ag	**Au**	-0.31	-0.55	-0.61	-0.62	-0.44	-
Ag	**Mg**	69.86	90.48	92.98	92.36	87.85	-
Ag	**Zn**	224.08	343.29	369.58	370.39	302.01	-
Ag	**Ca**	167.71	279.68	292.99	300.82	222.29	-
Ag	**Ba**	328.26	568.24	607.98	621.88	447.94	-
Ag	**Cd**	94.47	128.12	135.12	133.91	122.36	-
Ag	**Hg**	100.42	155.73	160.08	163.93	129.11	-
Ag	**Al**	383.80	562.79	600.02	599.93	507.69	-
Ag	**Ga**	444.18	662.87	709.07	709.90	591.36	-
Ag	**In**	429.62	638.66	682.72	683.29	571.19	-
Ag	**Ge**	1123.57	1728.83	1854.89	1863.33	1508.42	-
Ag	**Sn**	866.85	1298.82	1388.45	1391.43	1153.62	-
Au	**Li**	-4.89	-8.73	-9.60	-9.75	-6.91	-
Au	**Na**	-15.08	-27.22	-29.78	-30.35	-21.24	-
Au	**K**	6.74	11.91	13.21	13.34	9.60	-
Au	**Rb**	5.80	10.26	11.37	11.50	8.26	-
Au	**Cs**	29.12	44.44	49.59	48.62	41.70	-
Au	**Cu**	-20.97	-38.22	-41.63	-42.56	-29.44	-
Au	**Ag**	0.31	0.55	0.61	0.61	0.44	-
Au	**Ca**	169.58	282.76	296.30	304.20	224.70	-
Au	**Ba**	329.46	569.63	609.54	623.39	449.27	-
Au	**Zn**	220.96	337.77	363.53	364.27	297.50	-
Au	**Cd**	93.07	125.86	132.61	131.41	120.37	-
Au	**Hg**	101.70	158.00	162.50	166.44	130.78	-
Au	**Al**	378.94	554.49	590.89	590.74	500.69	-
Au	**Ga**	438.55	653.10	698.34	699.08	583.23	-
Au	**In**	424.16	629.21	672.35	672.84	563.32	-
Au	**Ge**	1111.08	1706.51	1830.45	1838.59	1490.21	-
Au	**Sn**	599.66	870.19	921.62	923.03	784.78	-
Be	**Li**	11.43	15.48	16.01	16.01	14.05	-
Be	**Na**	3.92	5.20	5.58	5.36	5.51	-
Be	**K**	22.64	31.03	31.84	32.21	26.72	-
Be	**Mg**	36.68	53.80	57.21	57.83	43.45	-
Be	**Tl**	62.10	87.67	90.99	92.67	70.88	-
Be	**Pb**	117.84	161.78	166.01	169.23	133.35	-
Mg	**Li**	0.69	2.52	4.31	3.79	2.78	-
Mg	**Na**	-6.59	-8.93	-8.11	-8.68	-7.02	-
Mg	**K**	7.85	13.47	16.17	15.65	12.41	-
Mg	**Cu**	-12.17	-17.82	-17.74	-18.38	-14.49	-
Mg	**Ag**	3.96	7.56	9.77	9.26	7.17	-
Mg	**Be**	9.41	12.09	13.78	13.09	13.08	-
Mg	**Cd**	-8.52	-15.01	-15.80	-16.37	-11.05	-
Mg	**Al**	43.25	56.02	58.51	57.94	54.41	-
Mg	**In**	49.84	65.79	69.26	68.57	63.34	-
Mg	**Tl**	49.90	65.88	69.36	68.68	63.43	-
Mg	**Sn**	147.56	202.64	213.08	212.62	187.73	-
Mg	**Pb**	131.67	178.73	186.88	186.59	166.25	-
Zn	**Cu**	20.07	32.38	35.44	35.65	26.59	-
Zn	**Al**	58.00	84.90	87.86	89.67	70.25	-
Zn	**Pb**	120.65	171.13	176.37	179.40	145.61	-
Cd	**Li**	14.65	25.04	28.33	28.23	21.04	-
Cd	**Cu**	0.83	3.47	4.95	4.75	2.58	-
Cd	**Mg**	14.59	24.59	26.08	26.78	18.94	-
Cd	**Al**	40.18	53.37	55.22	55.22	49.90	-
Cd	**In**	42.24	55.77	58.08	57.83	52.86	-
Al	**Li**	-4.83	-7.65	-7.86	-8.33	-4.89	-
Al	**Na**	-11.01	-16.36	-16.80	-17.42	-12.26	-
Al	**K**	4.09	5.03	5.10	4.90	5.63	-

Al	**Cu**	-14.78	-21.65	-22.26	-22.94	-16.80	-
Al	**Ag**	-1.24	-2.56	-2.66	-3.02	-0.65	-
Al	**Be**	-25.68	-36.96	-38.29	-39.07	-30.19	-
Al	**Mg**	-7.09	-8.85	-8.44	-8.77	-7.54	-
Al	**Ca**	23.78	36.10	39.75	39.45	31.37	-
Al	**Zn**	-25.69	-36.97	-38.30	-39.08	-30.20	51
Al	**Cd**	-16.02	-22.23	-22.70	-23.20	-18.53	-
Al	**Ga**	-5.85	-9.04	-9.51	-9.75	-6.94	-
Al	**In**	-4.68	-7.23	-7.61	-7.79	-5.57	-
Al	**Si**	17.27	19.53	19.93	19.44	21.07	-
Al	**Ge**	16.55	19.10	19.27	19.01	19.77	-
Al	**Pb**	35.79	49.75	51.17	52.08	41.93	-
In	**Mg**	8.40	17.03	18.97	19.48	11.76	-
In	**Cd**	-6.37	-6.39	-5.98	-5.90	-7.14	-
In	**Al**	-2.02	-3.68	-3.75	-3.99	-2.39	-
In	**Ga**	-0.72	-1.24	-1.28	-1.34	-0.87	-
In	**Tl**	-0.02	-0.04	-0.04	-0.04	-0.03	-
In	**Sn**	33.43	45.06	46.46	46.75	40.90	-
In	**Pb**	37.22	51.92	53.47	54.18	45.40	-
In	**Bi**	423.40	666.37	703.22	718.21	533.04	-
In	**Be**	-57.94	-81.45	-83.85	-85.02	-71.05	-
Sn	**Cu**	-6.97	-9.63	-9.24	-9.80	-7.22	-
Sn	**Mg**	-7.09	-7.41	-6.53	-6.76	-7.28	-
Sn	**Cd**	-17.29	-22.86	-22.99	-23.41	-20.07	-
Sn	**In**	-17.74	-24.17	-24.77	-25.11	-21.12	-
Sn	**Pb**	6.13	9.79	10.25	10.56	7.40	-
Sn	**Sb**	30.43	41.47	42.60	43.13	36.37	-
Sn	**Bi**	293.14	451.29	477.97	486.58	362.19	-
Pb	**Li**	0.18	0.57	1.54	1.01	1.77	-
Pb	**Na**	-5.06	-6.93	-6.31	-6.89	-4.82	-
Pb	**K**	6.44	9.49	10.75	10.33	9.53	-
Pb	**Be**	-28.90	-40.76	-41.97	-42.67	-34.85	-
Pb	**Mg**	-11.69	-14.28	-13.77	-14.09	-13.08	-
Pb	**Zn**	-28.96	-40.86	-42.08	-42.78	-34.93	30
Pb	**Cd**	-21.27	-29.00	-29.47	-29.99	-25.21	-
Pb	**Hg**	16.75	29.12	32.71	32.81	23.26	-
Pb	**Al**	-18.72	-25.79	-26.46	-26.83	-22.50	-
Pb	**In**	-21.37	-30.06	-30.95	-31.45	-25.77	-
Pb	**Tl**	-21.39	-30.08	-30.98	-31.48	-25.79	-
Pb	**Sn**	-3.68	-6.17	-6.40	-6.67	-4.42	-
Pb	**Bi**	274.31	428.15	453.40	462.19	342.56	-
Sb	**Mg**	-88.31	-117.70	-117.42	-120.53	-99.86	-
Sb	**Pb**	-71.01	-93.10	-94.69	-95.75	-83.46	-
Bi	**Pb**	-284.04	-448.80	-469.68	-483.47	-343.22	-

Table 9. κ_{NN} for dilutes alloys (in $10^{-6}\ \Omega - cm$).

Dilute Alloys		Present Results					Expt. [10]
Solute	**Solvent**	**H**	**T**	**IU**	**F**	**S**	
Li	**Na**	-0.49	0.11	2.38	1.74	0.89	-
Li	**K**	4.18	8.79	12.46	11.81	7.98	-
Li	**Rb**	3.95	8.38	11.99	11.34	7.64	-
Li	**Cs**	17.29	32.70	38.22	38.11	26.73	-
Li	**Cu**	34.72	60.92	67.12	66.58	53.27	-
Li	**Ag**	40.79	73.31	80.45	80.17	62.92	-
Li	**Au**	27.70	46.66	51.77	50.95	42.13	-
Li	**Mg**	-9.07	-26.74	-27.68	-29.65	-16.02	-
Li	**Cd**	7.54	5.01	3.60	2.81	8.84	-
Na	**Li**	-1.96	-2.66	-0.93	-1.53	-1.40	-
Na	**K**	2.72	6.09	9.37	8.72	5.79	15
Na	**Rb**	2.65	5.97	9.23	8.57	5.69	-
Na	**Cs**	-13.26	-23.09	-23.96	-24.74	-17.83	-
Na	**Cu**	10.52	12.04	9.60	9.52	13.38	-
Na	**Ag**	4.20	-2.78	-3.02	-4.60	3.78	-
Na	**Au**	4.48	-2.12	-2.46	-3.97	4.21	-
K	**Li**	-22.81	-40.30	-43.33	-44.26	-31.66	-
K	**Na**	-0.09	-2.51	-1.33	-2.17	0.23	23
K	**Rb**	-3.41	-8.12	-7.06	-8.02	-4.45	-
K	**Cs**	-3.13	-7.66	-6.58	-7.53	-4.06	-
Rb	**Li**	-16.22	-28.45	-28.26	-29.32	-22.46	-
Rb	**Na**	5.32	6.78	8.11	7.51	7.87	-
Rb	**K**	-1.55	-4.99	-3.86	-4.76	-1.83	-
Rb	**Cs**	-1.47	-4.85	-3.71	-4.60	-1.71	-
Cs	**Li**	19.02	30.00	33.45	32.63	28.37	-
Cs	**Na**	24.04	39.89	43.79	43.24	36.09	-
Cs	**K**	13.80	19.78	22.74	21.66	20.35	-
Cs	**Rb**	-14.84	-34.79	-34.91	-37.07	-23.40	-
Cu	**Li**	2.42	4.81	6.98	6.43	4.86	-
Cu	**Na**	-0.09	0.70	2.53	1.94	1.46	-
Cu	**K**	5.48	9.80	12.29	11.83	8.92	-
Cu	**Rb**	5.21	9.36	11.83	11.35	8.56	-
Cu	**Cs**	19.27	32.02	34.73	35.08	26.33	-
Cu	**Ag**	3.72	6.94	9.26	8.74	6.60	-
Cu	**Au**	3.64	6.81	9.12	8.60	6.49	-
Cu	**Ca**	-2.93	-3.16	0.06	-1.16	-0.87	-
Cu	**Ba**	8.76	16.02	20.80	19.81	14.94	-
Cu	**Be**	-16.34	-25.88	-27.31	-27.80	-21.18	-
Cu	**Mg**	-12.85	-19.74	-19.08	-20.06	-15.22	-
Cu	**Zn**	-16.32	-25.83	-27.23	-27.73	-21.12	-
Cu	**Cd**	-14.36	-22.34	-22.36	-23.20	-17.62	-
Cu	**Hg**	-7.57	-10.85	-8.59	-9.78	-7.40	-
Cu	**Al**	-23.75	-37.41	-38.84	-39.77	-30.27	-
Cu	**Ga**	-24.24	-38.30	-40.15	-40.97	-31.20	-
Cu	**In**	-24.14	-38.11	-39.87	-40.71	-31.00	-
Cu	**Ge**	-33.50	-53.35	-57.32	-57.97	-44.22	-
Cu	**Sn**	-32.75	-51.87	-54.79	-55.76	-42.48	48, 114
Cu	**Sb**	-41.22	-65.38	-69.37	-70.48	-53.71	-
Ag	**Li**	-1.10	-1.11	1.53	0.59	0.55	-
Ag	**Na**	-3.94	-5.96	-3.95	-4.87	-3.57	-
Ag	**K**	2.46	4.97	8.25	7.34	5.62	-
Ag	**Rb**	2.14	4.42	7.65	6.74	5.17	-
Ag	**Cs**	22.73	39.45	44.46	44.40	33.22	-
Ag	**Cu**	-5.80	-9.16	-7.64	-8.52	-6.33	-

Ag	**Au**	0.31	1.29	4.20	3.27	2.56	-
Ag	**Mg**	-22.01	-36.20	-37.07	-38.20	-28.82	-
Ag	**Zn**	-26.31	-43.69	-47.61	-47.98	-36.47	-
Ag	**Ca**	-10.95	-17.19	-13.96	-15.74	-11.68	-
Ag	**Ba**	2.33	5.52	11.65	9.81	7.57	-
Ag	**Cd**	-23.78	-39.27	-41.16	-42.07	-31.81	-
Ag	**Hg**	-16.09	-26.00	-24.36	-25.95	-19.43	-
Ag	**Al**	-38.45	-63.75	-68.65	-69.48	-52.72	-
Ag	**Ga**	-39.12	-64.92	-70.45	-71.11	-54.01	-
Ag	**In**	-38.98	-64.67	-70.05	-70.75	-53.73	-
Ag	**Ge**	-54.04	-89.88	-99.40	-99.66	-75.90	-
Ag	**Sn**	-52.27	-86.85	-94.80	-95.50	-72.55	-
Au	**Li**	-0.73	-0.45	2.23	1.31	1.07	-
Au	**Na**	-3.61	-5.38	-3.33	-4.23	-3.11	-
Au	**K**	2.88	5.70	9.03	8.14	6.20	-
Au	**Rb**	2.55	5.15	8.42	7.53	5.74	-
Au	**Cs**	23.13	40.08	45.10	45.06	33.72	-
Au	**Cu**	-5.52	-8.65	-7.09	-7.96	-5.93	-
Au	**Ag**	0.79	2.14	5.11	4.20	3.24	-
Au	**Ca**	-10.37	-16.14	-12.84	-14.59	-10.85	-
Au	**Ba**	3.14	6.94	13.16	11.35	8.69	-
Au	**Zn**	-26.41	-43.79	-47.68	-48.06	-36.55	-
Au	**Cd**	-23.68	-39.03	-40.87	-41.78	-31.63	-
Au	**Hg**	-15.65	-25.19	-23.48	-25.05	-18.80	-
Au	**Al**	-38.51	-63.73	-68.59	-69.42	-52.72	-
Au	**Ga**	-39.24	-65.01	-70.49	-71.16	-54.09	-
Au	**In**	-39.08	-64.73	-70.07	-70.78	-53.79	-
Au	**Ge**	-54.41	-90.37	-99.85	-100.13	-76.29	-
Au	**Sn**	85.59	133.03	142.62	142.70	118.01	-
Be	**Li**	-5.09	-7.03	-7.41	-7.47	-5.98	-
Be	**Na**	-7.49	-10.59	-11.12	-11.27	-8.68	-
Be	**K**	-2.10	-2.61	-2.81	-2.74	-2.61	-
Be	**Mg**	-21.42	-31.06	-32.41	-33.10	-24.33	-
Be	**Tl**	-22.76	-33.53	-34.93	-35.82	-25.53	-
Be	**Pb**	-44.74	-64.90	-67.73	-69.18	-50.79	-
Mg	**Li**	-19.39	-32.30	-34.35	-35.18	-25.34	-
Mg	**Na**	-17.75	-29.91	-31.80	-32.62	-23.20	-
Mg	**K**	-20.23	-33.32	-35.46	-36.24	-26.44	-
Mg	**Cu**	-16.01	-27.26	-28.98	-29.78	-20.94	-
Mg	**Ag**	-19.89	-32.96	-35.06	-35.87	-25.99	-
Mg	**Be**	9.80	11.71	12.19	11.86	12.45	-
Mg	**Cd**	-5.18	-12.26	-13.17	-14.01	-7.00	-
Mg	**Al**	6.88	5.04	5.04	4.27	8.53	-
Mg	**In**	10.47	10.79	11.12	10.47	13.19	-
Mg	**Tl**	10.50	10.84	11.17	10.52	13.22	-
Mg	**Sn**	20.36	24.64	25.67	25.03	25.89	-
Mg	**Pb**	15.21	16.39	16.94	16.12	19.20	-
Zn	**Cu**	-11.74	-18.07	-18.92	-19.33	-14.50	-
Zn	**Al**	-1.18	-4.94	-5.11	-5.87	-0.85	-
Zn	**Pb**	2.77	-0.15	-0.10	-1.01	4.25	-
Cd	**Li**	-17.93	-29.02	-30.55	-31.29	-23.04	-
Cd	**Cu**	-15.19	-25.12	-26.40	-27.15	-19.48	-
Cd	**Mg**	-12.33	-22.61	-23.68	-24.76	-15.71	-
Cd	**Al**	4.56	2.11	2.27	1.39	6.03	-
Cd	**In**	7.96	7.44	7.85	7.09	10.38	-
Al	**Li**	-7.27	-10.81	-11.61	-11.70	-8.98	-
Al	**Na**	-6.50	-9.87	-10.71	-10.78	-8.08	-
Al	**K**	-7.75	-11.27	-11.98	-12.08	-9.50	-

Al	**Cu**	-5.73	-8.88	-9.71	-9.77	-7.18	-
Al	**Ag**	-7.53	-11.09	-11.86	-11.95	-9.27	-
Al	**Be**	4.89	5.29	4.89	4.92	5.59	-
Al	**Mg**	-3.28	-6.45	-7.65	-7.69	-4.46	-
Al	**Ca**	-11.77	-18.16	-19.82	-19.96	-14.72	-
Al	**Zn**	4.78	5.13	4.72	4.74	5.45	51
Al	**Cd**	-0.71	-2.78	-3.75	-3.77	-1.31	-
Al	**Ga**	6.17	6.25	5.52	5.55	6.95	-
Al	**In**	5.78	5.68	4.91	4.94	6.47	-
Al	**Si**	16.39	20.21	20.17	20.25	19.37	-
Al	**Ge**	14.38	17.28	17.00	17.07	16.88	-
Al	**Pb**	8.17	8.24	7.27	7.30	9.19	-
In	**Mg**	6.62	7.29	6.95	6.89	7.79	-
In	**Cd**	9.11	10.84	10.70	10.66	10.93	-
In	**Al**	21.47	27.51	28.02	28.01	26.30	-
In	**Ga**	20.26	25.75	26.15	26.13	24.76	-
In	**Tl**	19.93	25.27	25.63	25.60	24.33	-
In	**Sn**	28.63	36.68	37.36	37.34	35.07	-
In	**Pb**	26.96	34.26	34.78	34.75	32.95	-
In	**Bi**	10.41	9.51	8.17	7.98	11.70	-
In	**Be**	51.97	67.87	69.22	69.43	63.65	-
Sn	**Cu**	-8.43	-13.04	-13.86	-14.10	-10.43	-
Sn	**Mg**	-7.30	-12.80	-13.80	-14.24	-9.00	-
Sn	**Cd**	-3.77	-7.72	-8.46	-8.85	-4.63	-
Sn	**In**	4.38	3.01	2.66	2.25	5.45	-
Sn	**Pb**	6.54	5.05	4.63	4.10	8.14	-
Sn	**Sb**	13.95	14.77	14.70	14.14	17.30	-
Sn	**Bi**	-26.08	-43.14	-46.21	-47.40	-32.19	-
Pb	**Li**	3.97	5.82	5.87	6.06	4.69	-
Pb	**Na**	5.61	8.09	8.18	8.41	6.66	-
Pb	**K**	1.84	2.83	2.83	2.95	2.13	-
Pb	**Be**	16.80	22.43	22.81	23.09	20.09	-
Pb	**Mg**	17.42	24.17	24.52	25.00	20.80	-
Pb	**Zn**	16.83	22.48	22.86	23.14	20.13	30
Pb	**Cd**	17.58	24.13	24.50	24.93	21.00	-
Pb	**Hg**	15.43	21.85	22.14	22.66	18.40	-
Pb	**Al**	25.83	34.85	35.42	35.92	30.88	-
Pb	**In**	25.57	34.33	34.91	35.37	30.57	-
Pb	**Tl**	25.57	34.33	34.90	35.36	30.57	-
Pb	**Sn**	33.53	44.72	45.48	46.03	40.10	-
Pb	**Bi**	42.22	59.10	59.93	61.19	50.38	-
Sb	**Mg**	2.17	-5.18	-8.64	-8.93	0.95	-
Sb	**Pb**	70.72	83.06	81.54	81.40	83.76	-
Bi	**Pb**	0.03	-19.50	-28.23	-28.90	-4.98	-