

effective impurity potential accounting for electron screening is given by

$$v(q) = v_0(q)/\epsilon(q). \quad (5)$$

Here  $v_0(q)$  is the Fourier transform of  $v_0(r)$

$$v(q) = -4\pi U \frac{\sin q r_s - q r_s \cos q r_s}{q^3}, \quad (6)$$

and  $\epsilon(q)$  is the dielectric constant in the random phase approximation.

$$\epsilon(q) = 1 + \frac{4e^2 m k_F}{\pi \hbar^2 q^2} \left[ \frac{1}{2} + \frac{k_F}{2q} \left( 1 - \frac{q^2}{4k_F^2} \right) \ln \left| \frac{q + 2k_F}{q - 2k_F} \right| \right], \quad (7)$$

where  $k_F$  is the Fermi wave vector. If it is assumed that the Fermi surface is spherical (i.e. neglecting the neck electrons in the noble metal alloys) the resistivity can be calculated from [16]

$$\rho_0 = \frac{c(1-c)m^2}{4\pi \hbar^3 k_F^3} \int_0^{2k_F} |v(q)|^2 q^3 dq, \quad (8)$$

where  $c$  is the concentration of Au atoms.

The volume derivative of (8) is easily shown to be

$$\frac{d \ln \rho_0}{d \ln V} = -5 \frac{d \ln k_F}{d \ln V} - 2 \frac{\int_0^2 dx \frac{(\sin \alpha x - \alpha x \cos \alpha x)^2}{x^3 \epsilon^2(x)} \frac{d \ln \epsilon(x)}{d \ln V}}{\int_0^2 dx \frac{(\sin \alpha x - \alpha x \cos \alpha x)^2}{x^3 \epsilon^2(x)}}, \quad (9)$$

where  $x \equiv q/k_F$ ,  $\alpha \equiv k_F r_s$ ,

$$\frac{d \ln \epsilon(x)}{d \ln V} = \frac{1}{3} \left[ 1 + \frac{\pi \hbar^2 k_F}{2 m e^2} \left( \frac{x^2}{1 + \frac{(1-x^2/4) \ln \left| \frac{1+x/2}{1-x/2} \right|}} \right) \right]^{-1}, \quad (10)$$

and  $U$  is assumed to be independent of volume and concentration. In the free electron approximation  $d \ln k_F / d \ln V = -1/3$ . The integrals can be evaluated numerically if  $k_F$  and  $r_s$  are known; for both Ag and Au  $k_F = 1.20 \text{ \AA}^{-1}$  and  $r_s = 1.59 \text{ \AA}$  [18]. Evaluating the integrals yield  $d \ln \rho_0 / d \ln V = 1.38$  for all Ag-Au alloys. As seen in Table 1 this is in general agreement with the experimental values; however, this model does not predict the concentration dependence. A similar calculation using this model was made for the Cu-Ag and Cu-Au alloys; in these cases the model predicted both the wrong sign and magnitude (in the case of the pseudopotential calculations [15] agreement between theory and experiment was obtained for the Cu-Ag alloys, but not the Ag-Au alloys).

These discrepancies in the theoretical prediction (from both models) are not too surprising because the effect of the low lying filled d-bands on the scattering potential was not explicitly considered. It is well known that the filled d-bands in the noble metals strongly interact with the conduction electrons in certain directions [1, 17]. From optical measurements [19] it has been shown that the d-levels of Cu and Ag do not overlap and form separate d-states in the alloys,