^{109}Ag Knight Shift in an $Ag_{0.96}Al_{0.04}$ Alloy

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The ^{109}Ag Knight shift in a $Ag_{0.96}Al_{0.04}$ alloy has been measured with respect to ^{109}Ag metal at room temperature. The change in shift is −0.015 (±3%).

This note reports the ^{109}Ag Knight shift change in an $Ag_{0.96}Al_{0.04}$ alloy from pure Ag. The ^{109}Ag resonance in Ag-based alloys containing nontransition impurities has been studied extensively *(3, 4)* and the solute Knight shifts in these alloys have been measured and discussed in recent work *(1, 2)*. However, the Ag shift in the Ag–Al alloy was not reported.

Experimental

The $Ag_{0.96}Al_{0.04}$ alloy is the same sample prepared and characterized by Bennett et al. *(1)* as part of their study. Our measurements were made in the neighborhood of 15 kG on a Varian wide-line spectrometer at room temperature. The probe was set to be in the absorption mode with the sample in place. Furthermore, the resulting symmetric line shape confirmed that within experimental error there was negligible admixture of dispersion. Magnetic field sweeps through the line were made in both forward and reverse directions to be certain no distortion would be introduced by the filter following the phase detector. A modulation frequency of 10 Hz and an *RF* field of 0.3 G were utilized and time averaging was employed to improve signal to noise ratio.

The change in ^{109}Ag Knight shift in the alloy measured with respect to ^{109}Ag metal is

$$\Delta K \equiv K_{\text{alloy}} - K_{\text{metal}} = -0.015(\pm 3)\% \qquad (1)$$

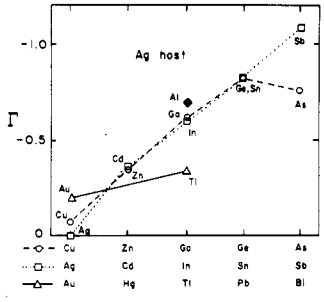

Figure 1. $\Gamma = (1/K)\Delta K/\Delta c$ values for impurities in a Ag host vs. position of impurity in periodic table
Dashed, dotted, and solid lines connect points for impurities occurring in Cu, Ag, and Au rows, respectively. From Bennett et al. *(2)*

The ΔK was measured by the shift between the alloy and pure metal absorption derivative crossover points. The observed peak to peak linewidth in the alloy was 3.5(10) G.

Assuming linearity, the reduced Knight shift is

$$\Gamma \equiv \frac{1}{c}\frac{\Delta K}{K} = -0.71$$

It is not useful to assign an error to Γ at this time for several reasons. Only one alloy was measured. The error in the nominal composition, c, would also be reflected in Γ. Even more important, although our line appears symmetric, asymmetry in the line shape may lead to large systematic errors in Γ. We now discuss this latter point.

The value of Γ is in reasonable agreement with those reported by Rowland *(4)* for ^{109}Ag in Ag–In (Γ = 0.60, 0.70) and Ag-Ga (Γ = 0.62) alloys. We would expect that since Al, Ga, and In have the same valence, they would produce similar but not identical effects on the host *(2)* K. It is important to note that the data points in the previous measurements *(4)* on Ag–In had a fair amount of scatter. In addition, the alloys containing less than about 3% In have asymmetric Ag line shapes, for reasons discussed by Rowland *(4)* and Bennett et al. *(2)*. The direction of the asymmetry is such that ΔK, when measured by the derivative crossover, will tend to be smaller than those measured at higher concentration where the line shape is more symmetric. It is not surprising that our single point Γ is not in exact agreement with that computed by Rowland using the best straight line through all the Ag–In data points. Figure 1 shows the Ag–Al point superimposed on the plot of Γ values of Bennett et al. *(2)*. The Al $|\Gamma|$ is larger than that of any of the trivalent solutes. It is reassuring that the decreasing magnitude of Γ in the trivalent column is consistent with the Al–Ga–In–Tl order of the periodic table.

Acknowledgment

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