

Photoelectron and Magnetic Circular Dichroism Spectra of $D0_3$ -related $(\text{Fe}_{1-x}\text{V}_x)_3\text{Al}$ Alloys

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We have measured photoelectron and magnetic circular dichroism (MCD) spectra near the $L_{2,3}$ edges of the transition metal elements in $D0_3$ -related pseudo-binary alloys $(\text{Fe}_{1-x}\text{V}_x)_3\text{Al}$ in order to clarify their electronic structure. The pseudo-binary alloys show fascinating electronic and magnetic properties such as anomalous negative temperature dependence of the electrical resistivity and relatively sharp reduction of the Curie temperature on partial substitution of another $3d$ element for Fe in an ordered ferromagnet Fe_3Al .¹⁾ The Heusler-type Fe_2VAl is a possible candidate for a $3d$ heavy fermion system.²⁾

Typical total photoelectric yield spectra for Fe_3Al and photoelectron energy distribution curves (EDC) of Fe_3Al and Fe_2VAl are shown in Figs.1 and 2, respectively. The yield spectra reveal fairly large MCD. We could make rough estimates of $\langle L_z \rangle = 0.02 \pm 0.05$ and $\langle S_z \rangle = 1.5 \pm 0.4$, using the sum rules³⁾ and neglecting inequivalence in the Fe sites.

The main valence band of Fe_3Al is narrow compared to that of Fe_2VAl and a calculated band,⁴⁾ while the band of Fe_2VAl is broader than a theoretical one.⁵⁾ Resonance behavior of the EDC suggests that both the V and Fe $3d$ states spread over the main band in Fe_2VAl .

Detailed comparison of the present results with the available theoretical and experimental works will be reported elsewhere.

References

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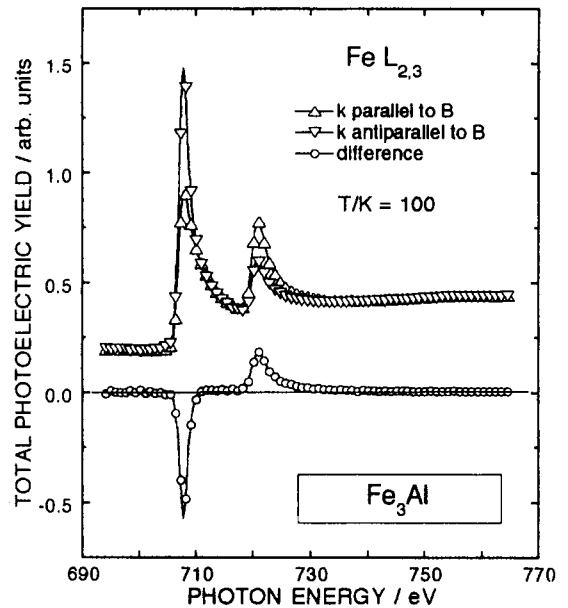


Fig.1 Total photoelectric yield of Fe_3Al .

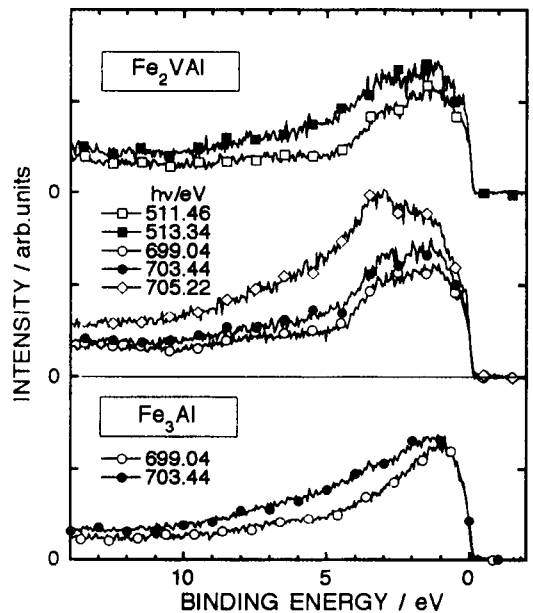


Fig.2 Photoelectron spectra of Fe_3Al and Fe_2VAl measured at several photon energies.