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Enhanced magnetic exchange under pressure in Au_4V and $Au_{1-x}V_x$ dilute alloys

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Previous studies of the dilute alloy system $Au_{1-x}V_x$ revealed a disorder-order transition upon annealing for $x = 0.2$, with the material transforming from the disordered Au FCC lattice with $a = 4.072$ Å, to the ordered compound Au_4V, having the highly anisotropic $MoNi_4$ structure with lattice parameters $a = 6.40$ Å and $b = 3.98$ Å. Accompanying this transition to an ordered crystalline lattice was the appearance of ferromagnetic order with a Curie temperature $T_C \sim 45$ K. High pressure electrical resistivity measurements using nearly hydrostatic piston-cylinder, Bridgman anvil, and designer diamond anvil cells on Au_4V have revealed an increase of T_C with pressure up to 200 kbar, indicating an enhancement of the magnetic exchange interaction as a function of pressure. Dilute $Au_{1-x}V_x$ samples with vanadium concentration $x \leq 0.01$ exhibit Kondo-like behavior in the electrical resistivity due to the presence of local moments on the V sites. Analysis of the magnetic contribution to the electrical resistivity in dilute $Au_{1-x}V_x$ yields a Kondo temperature $T_K \sim 200$ K, which, for $x = 0.005$, is found to increase with increasing pressure, indicating an enhanced magnetic exchange interaction similar to that seen in Au_4V.

Keywords : ferromagnetism, Kondo effect, magnetic exchange