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The effect of chemical pressure on the ferromagnetic (FM) ordering of Ce*TX* compounds

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Abstract :

The transport and thermodynamic properties of Ce*TX*(*T* = Au,Cu; *X* = Ge,Si) compounds have been studied. These well-ordered hexagonal compounds have shown (FM) ordering anomalies in magnetic susceptibility, electrical resistivity and specific heat at FM transition temperature T_C, (10K, 10K and 15K for CeAuGe [1], CeCuGe and CeCuSi [2], respectively). The location of magnetic ordering has been observed to be unstable under the influence of applied magnetic field [2], where the FM ordering has been observed to shift upwards in temperature. However, the application of chemical pressure as observed from physical properties as well as magnetic properties measurements revealed a continuous suppression of T_C, associated with Ce moments, resulting in the FM transition temperature approaching 0K as La content is increased. The calculation of the effective magnetic moment for small La contents was observed to be 2.54 μ_B/mol in agreement with the value of the full magnetic moment for Ce^{3+} ion. Despite the observed suppression of T_C, observed in these dilution compounds, it was observed from powder x-ray diffraction characterization that the crystal structures of the compounds were retained as hexagonal belonging to space group number 186 ($(Ce_{1-x}La_x)AuGe$) and 194 for $(Ce_{1-x}La_x)CuGe$ and $(Ce_{1-x}La_x)CuSi$. Rietveld refinement profile indicated that the lattice parameters *a* and *c* and the volume *V* of the dilution compounds were increased with the increase in La content. This work presents the first results of the effect of isostructural substitution of Ce with La ($(Ce_{1-x}La_x)AuGe$; $(Ce_{1-x}La_x)CuGe$ and $(Ce_{1-x}La_x)CuSi$) having various x contents. Measurements of magnetic susceptibility, electrical resistivity and specific heat for the dilution compounds gave the first evidence of the possibility of non-Fermi liquid behavior as chemical pressure was used to tune ferromagnetism to lower temperatures. [1] Pöttgen R, Borrmann H and Kremer R K, 1996 J. Magn. Magn. Mater. 152 196[2] Yang F, Kuang J P, Li J, Bruck E, Nakotte H, de Boer F R, Wu X, Li Z and Wang Y,1991 J. Appl. Phys. 69 470

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