Quantum Phase Transition Induced by Chemical Substitution in the valence fluctuating System α-$YbAlB_4$

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The Yb-based heavy fermion system, α-$YbAlB_4$, has a noncentrosymmetric crystal structure, while the structure of the isostoichiometric system, β-$YbAlB_4$ is centrosymmetric[1]. β-$YbAlB_4$ is a rare example of the Yb based heavy fermion systems that shows pronounced non-Fermi-liquid behaviors and a superconducting transition at 80 mK under ambient pressure and field[2,3,4]. On the other hand, α-$YbAlB_4$ at low temperatures is well fit to a Fermi liquid type description[4]. Both α and β-$YbAlB_4$ are valence fluctuating systems with the valence of $Yb^{2.73+}$ and $Yb^{2.75+}$, in spite of showing Kondo lattice behaviors[5].
We have succeeded in substituting Fe for Al in α-$YbAlB_4$, and found a magnetic order at 10 K by magnetic susceptibility measurements. We will discuss the thermodynamic and transport properties in the vicinity of quantum phase transitions found in α-$YbAl_{1-x}Fe_xB_4$, compairing with β-$YbAlB_4$.

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