NANOSTRUCTURE FORMATION DURING RAPID SOLIDIFICATION PROCESS IN $Ce_{100-x}Al_x$ (x=45, 50) ALLOYS

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The heavy-fermion behavior in some compounds with Ce or Yb could be strongly enhanced by granular structure. The nanocrystalline state formation, crystallization processes, crystal structure of 10-30 nm particles in $Ce_{100-x}Al_x$ are investigated. The master alloys with x=45, 50 were prepared by arc-melting and subsequent melt-spinning. The XRD patterns for both compositions show AlCe nanocrystalline phase with the ClCs-type structure (Pm-3m space group) embedded in an amorphous matrix. This crystalline AlCe phase is known as a metastable one, without unequivocally distribution of Ce and Al atoms in the lattice cell. The $Ce_{100-x}Al_x$ (x=45, 50) ribbons due to differences in Ce/Al ratio solidify to different nanocrytalline states, what suggests that amount of nanocrystals could be roughly controlled by wheel velocity during rapid quenching process. The constant-heating DSC curves for $Ce_{50}Al_{50}$ and $Ce_{55}Al_{45}$ show two exothermal crystallization peaks. For $Ce_{55}Al_{45}$ third small feature is observed at about 350^oC, which is not visible for $Ce_{50}Al_{50}$ at this heating rate. Total enthalpy ΔH of first two peaks is about 20 J/g for both alloys. Additionally, effective acivation energies were determined by the means of Kissinger approximation.