Structural, thermal and magnetic characterization of Al-(Ni,Cr,Cu,Y)-Fe alloys

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Rapidly solidified aluminium alloys are promising materials which provide many beneficial properties compared to conventional Al-based alloys with crystalline structure. Better properties compared to crystalline alloys are resulted from chemical homogeneity and possibility to obtain unique structures like amorphous, quasicrystalline or nanocrystalline [1]. Improving of magnetic properties of these alloys have been described in the literature by many methods like f.e. primary crystallization of amorphous alloys [2]. Relatively good magnetic properties have been observed in Al-Fe-Ni [3] and Al-Fe-Cu [4] alloying compositions. The aim of the studies was characterization of structural, magnetic and thermal properties of aluminium alloys with Ni, Cr, Cu, Y and Fe additions. The samples were prepared with a different cooling rates by induction melting (master alloys), high-pressure casting (plates) and melt-spinning (ribbons). Phase identification was analized by X-ray diffraction method. The magnetic properties were examined using vibrating sample magnetometer and Mössbauer spectroscopy. Measurements of magnetic parameters were performed at room temperature and included field of coercive force (H_c), saturation magnetization (M_s), magnetic remanence (M_r) which were determined from hysteresis loops by vibrating sample magnetometer in magnetic fields up to 20 kOe. The ^{57}Fe Mössbauer spectra were measured at room temperature with a constant acceleration spectrometer with ^{57}Co:Rh source. Mössbauer spectra were fitted using doublets describing different local environments of a ^{57}Fe nuclide. The differential scanning calorimetry was conducted to determine the crystallization mechanisms of studied alloys.

References:

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