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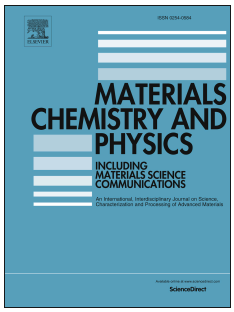

Thermomagnetic behavior of an as-quenched Cu-Al-Mn-Gd alloy

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Thermomagnetic behavior of an as-quenched Cu-Al-Mn-Gd alloy

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Abstract. The thermomagnetic behavior of the as-quenched Cu-9wt%Al-10wt%Mn-3wt%Gd alloy was studied using differential scanning calorimetry (DSC), optical microscopy, magnetization measurements with temperature and applied field. The results obtained showed that in the Cu-9wt%Al alloy the α, γ_1 and α_2 phases are produced from martensitic β' phase decomposition while in the Cu-9wt%Al-3wt%Gd alloy the higher fraction of produced γ_1 phase is not formed from martensite decomposition. In the Cu-9wt%Al-10wt%Mn and Cu-9wt%Al-10wt%Mn-3wt%Gd alloys the ferromagnetic Cu_2AlMn phase formation is dependent on the cooling rate and the martensitic transition seems to be changed by the presence of Gd.

Keywords: Metastable phases, Phase transitions, Cu-based alloy.

Introduction

Metastable phases can be produced on fast cooling when there is no enough time for all diffusive processes to be concluded, making metastable at lower temperatures the phases which are stable at higher temperatures. The cooling rate required to produce metastable phases can change depending on the kind of evaluated system. From thermodynamic point of view, the metastable phases are associated with a relative minimum in Gibbs energy of the system, which can evolve to another one, and so on until reaching the most stable phases of the analyzed system. Therefore, the heating of metastable phases can conduce to the formation of more stable phases in characteristics temperature and time ranges for each studied alloy. The knowledge on the metastable phases stability range can contribute for the defining of some applications for metallic materials. In Cu-rich corner from Cu-Al equilibrium diagram the β(A2) phase exists at high temperatures [1]. When this phase is rapidly cooled it undergoes ordering reactions to produce the β_2(B2) phase and then the β_1($D0_3$) phase, which is transformed in metastable martensitic phase at low temperature. This latter can assume three different kinds of structures depending on the Al content: β´, β_1´, (β_1´+ γ´) or γ´[2]. The Cu-