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THE EFFECT OF THE PROCESSING PARAMETERS ON THE MARTENSITIC TRANSFORMATION OF Cu-Al-Mn SHAPE MEMORY ALLOY

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Abstract:

The influence of processing, heat-treatment and aging of Cu-(8-9) wt% Al-(7-10) wt% Mn alloy on the kinetics and temperatures of martensitic transformation was investigated by calorimetric measurements. Cu-Al-Mn alloy was prepared by continuous casting, melt-spinner and by melting in the electric arc furnace. Alloys were further heat-treated at 900 °C for 30 minutes and quenched in water, as well as aged at 300 °C for 1 hour. Differential Scanning Calorimetry (DSC) was performed at 3 heating/cooling cycles from -50 to 250 °C. Non-isothermal measurements were determined at five different heating/cooling rates: 5, 10, 15, 20 and 25 °C/min. Activation energy was obtained according to Ozawa and Kissinger kinetic models. Microstructure analysis of investigated systems was performed by scanning electron microscopy (SEM). Results indicate the most intensive formation of martensitic structure in the as-cast state during continuous casting, where the partially formation of needle-like and V-shape martensite was observed. After solution treatment and quenching as well as aging, completely martensitic phase occurred in continuously cast alloy. XRD analysis detected Cu_2AlMn, Cu_3Al and Al_4Cu_9 phases in quenched specimens of continuously cast Cu-Al-Mn alloy and ribbon. The highest impact of the solution treatment and aging on the shifting of the martensitic temperatures was observed for Cu-Al-Mn ribbons, while in continuously cast Cu-Al-Mn alloy heat treatment and aging induced formation of different martensitic crystal structures. Kinetic investigations showed increasing start martensitic temperatures, M_s, and wider temperature interval of martensitic transformation with higher cooling rate. The highest values of activation energy of martensitic transformation was obtained for the continuously cast Cu-Al-Mn alloy.

Keywords: *shape memory alloys, Cu-based alloys, martensitic transformation, kinetics*

Introduction:

Shape memory effect, pseudoelasticity, and damping properties of shape memory alloys (SMA) are consequence of the thermoelastic martensitic transformation which makes them a highly interested functional materials with wide range of application [1,2,3]. Properties of shape memory alloys are strongly influenced by grain size and orientation. Coarse grains