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Experimental studies of formation conditions of nanocrystalline bcc-phase in the alloys Ce-Ag system

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The results of X-ray, rezistometrical and differential thermal assays of alloys $Ce_{100-x}Ag_x$ (x=8-37) have been represented, which were produced by quenching from the liquid state (QLS) and subsequent thermal treatment of rapidly quenched amorphous foils. It is shown that when a certain combination of chemical composition and cooling rate of the meltis present ($\upsilon\_$), metastable bcc-phase in the structure of the alloys is fixed. Under extreme conditions QLS ($3\cdot10^7$ K·c^{-1}) is formed in alloys with a silver content x=10-35at.%.The values of specific atomic volumes of the bcc-phase correspond with satisfactory accuracy with the linear concentration dependence calculated by the crystallographic parameters of the components of equilibrium intermediate phases Ce-Ag system. This means that the metastable bcc-phase has a wide range of homogeneity and crystallized polymorphic, i.e., maintaining the initial concentration of the alloys. Within the detection region of the bcc-phase only at a certain range of cooling rates is fixed $\upsilon\_^{min}$ - $\upsilon\_^{max}$. Beyond the lower limit of this range rapidly quenched foils retain the equilibrium phase composition (γ-Ce+CeAg), and during the crystallization process they are suppressed and alloys transform into an amorphous state. X-ray evaluation of grain sizes of bcc-phase, executed by the integrated width of the diffraction peak (110) give us values $L\_\approx$ 20-30 nm that is much smaller than the typical parameters of the microstructure for QLS products.

In the example of the eutectic composition alloy (x=21) it was found that under continuous heating of rapidly quenched amorphous strips at a rate $\upsilon_+ \approx 8\cdot10^{-2}$ K·c^{-1}, two stages of structural changes are consistently implemented. They area ccompanied by a total decrease of the electrical resistivity (ER) of approximately 2 times and exothermic effects with peaks of heat at temperatures of 398 and 493K. The first step is crystallization of metastable bcc-phase of the initial composition with effective crystal size $L_+\approx$ 8-9 nm. Similar single-phase structure, characterized by values L_+ up to 10 nm are formed as a result of the polymorphic crystallization of amorphous alloys with x=15-25. This process leads to the disappearance of ~17% of the excess resistivity and also leads to the change of temperature coefficient sign from negative to positive. At the final stage of the metastable bcc-phase undergoes decay into a mixture of equilibrium phases:γ-Ce+CeAg.