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Synthesis of Ag:Er alloy for MMC (Metallic magnetic calorimeters) sensor material using induction heating method

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Ag and Er in a carbon crucible with 2" inner diameter was melt by induction heating. The chamber of the heating furnace was pumped into vacuum and maintained at Ar gas atmospheric pressure to suppress Ag evaporation. The internal temperature of the carbon crucible was raised to 1700 oC even higher than Er melting point(1529 oC) to form a convention flow in melt metals. Convection of the metal liquid allows Er atoms to be homogeneously mixed throughout the sample. The synthesized Ag:Er alloy was assayed by mass spectroscopy and magnetic property measurement. The mass spectra taken from secondary ion mass spectrometry(SIMS) showed that the amounts of oxygen and magnetic impurities such as iron are negligibly small, which does not deteriorate MMC performance in mK region. The temperature dependence of measured magnetization showed paramagnetic property of Ag:Er alloy, which applies to estimate Er concentration. Among the synthesized 2" alloy disks with 12 mm thickness, the Er concentration at the bottom was at least more than 20 % higher than the surface, depending on the speed in cooling the heated carbon crucible. The Er atoms larger in mass than Ag are expected to be sedimented at the bottom of crucible during solidification of metal liquid. Ag:Er alloy liquid in the high temperature was rapidly cooled to make the Er atoms be uniformly distributed in 2" Ag:Er sputtering target. A thin film with a thickness of 3 μm for MMC will be fabricated from the synthesized 2" Ag:168Er target. The results of the thermal magnetic properties of the Ag:168Er films measured in the mK region will be shown and discussed in poster section.

Less than 5 years of experience since completion of Ph.D

N

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