

기계적합금화에 의한 비정질 Al-La-Ni-Fe 합금 제조

Amorphous Al-La-Ni-Fe alloys produced by mechanical alloying

울산대학교 O.Nguyen*, 최벽파, 권대환, 최형석, 김지순, 권영순

Al-based bulk metallic glasses are attractive materials for structural applications, as they combine high strength with lightweight. In this work, amorphous Al-La-Ni-Fe alloys with more than 80 at.% Al composition have been investigated. Amorphous powder material was produced by mechanical alloying elemental powder mixtures in a high-energy planetary ball-mill (AGO-2). When no PCA was used, severe sticking of the powder to the milling tools and agglomeration of powder particles were observed, leading to the formation of intermetallic phases instead of the amorphous phase. Hence, milling was carried out in hexane medium under protective Ar atmosphere. It was found that powder sticking can be reduced by using hexane and fine powder can be obtained. After milling an alloy of $\text{Al}_{82}\text{La}_{10}\text{Fe}_4\text{Ni}_4$ composition for 5h at 300 rpm speed, the amorphization of the material was found to set in. Nearly complete amorphization was observed with XRD after 250 h. SEM investigations revealed that the particle sizes decreased in this time range from 30-50 microns to less than 10 microns. DSC analyses of the glassy sample revealed a two-stage crystallization around 364°C and 428°C with no distinct glass transition being detected prior to crystallization. Amorphous powders were consolidated by spark-plasma sintering to produce bulk samples. At 340°C the samples remained mostly amorphous but exhibited low density. Further investigations will be done to optimize the sintering process and produce bulk samples with full density.