

기계적 합금화와 방전 플라즈마 소결을 이용한 Ti-Cu기 벌크비정질 재료의 제조

Ti-Cu-based bulk metallic glasses produced by mechanical alloying and spark-plasma sintering

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Titanium - based bulk metallic glasses are important potential engineering materials due to their high tensile strength and good corrosion resistance at room temperature. In this work, Ti-Cu-Ni-Sn quaternary amorphous alloys with 50 at.% Ti content have been investigated. Amorphous powder material was produced by mechanical alloying elemental powder mixtures in a high-energy planetary ball-mill (AGO-2) under protective Ar atmosphere. The amorphization of a $Ti_{50}Cu_{25}Ni_{20}Sn_5$ alloy was found to set in after milling for 2h at 300 rpm speed and to be nearly completed after 30h. DSC analyses of the glassy sample revealed two-stage crystallization around 491°C and 585°C with a distinct glass transition being detected prior to crystallization. Amorphous powders of $Ti_{50}Cu_{25}Ni_{20}Sn_5$ composition were consolidated by spark plasma sintering to produce bulk samples. Nearly full density of bulk samples can be obtained at 450°C sintering temperature, applying a high pressure of 500 MPa and low heating rate of 10°C per min. Powders of different compositions ($Ti_{50}Cu_{23}Ni_{20}Sn_7$, $Ti_{50}Cu_{32}Ni_{15}Sn_3$ and $Ti_{50}Cu_{25}Ni_{20}Co_5$) have also been investigated with respect to their microstructure, thermal properties and densification behavior and the results will be comparatively presented.