

# Characterization and Formation Mechanism of Zr-Cu and Zr-Cu-Al Metallic Glass Thin Film by Sputtering Process

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Bulk Metallic Glasses (BMGs or amorphous alloy) exhibit high strength and good corrosion resistance. Applications of thin films and micro parts of BMGs have been used a lot since its inception in the research of BMGs. However, Application and fabrication of BMGs are limited to make structural materials. Thin films of BMGs which is sputtered on the surface of structural materials by sputtering process is used to improve limits about application of BMGs. In order to investigate the difference of properties between designed alloys and thin films, we identified that thin films deposited on the surface that have the characteristic of the amorphous films and the composition of designed alloys. Zr-Cu (Cu=30, 35, 38, 40, 50 at.%) and Zr-Cu-Al (Al=10 at.% fixed, Cu=26, 30, 34, 38 at.%) alloys were fabricated with Zr (99.7% purity), Cu (99.997% purity), and Al (99.99% purity) as melting 5 times by arc melting method before rods 2mm in diameter was manufactured. In order to analyze GFA (Glass Forming Ability), rods were observed by Optical Microscopy and SEM and  $T_g$ ,  $T_x$ , ( $T_x$  is crystallization temperature and  $T_g$  is the glass transition temperature) and  $T_m$  were measured by DTA and DSC. Powder was manufactured by Gas Atomizer and target was sintered using powder in large supercooled liquid region ( $=T_x-T_g$ ) by SPS(Spark Plasma Sintering). Amorphous foil was prepared by RSP process with 5 gram alloy button. The composition of the foil and sputtered thin film was analyzed by EDS and EPMA. In the result of DSC curve, binary alloys ( $Zr_{62}Cu_{38}$ ,  $Zr_{60}Cu_{40}$ ,  $Zr_{50}Cu_{50}$ ) and ternary alloys ( $Zr_{64}Al_{10}Cu_{26}$ ,  $Zr_{56}Al_{10}Cu_{34}$ ,  $Zr_{52}Al_{10}Cu_{38}$ ) have  $T_g$  except for  $Zr_{70}Cu_{30}$  and  $Zr_{60}Al_{10}Cu_{30}$ . The compositions with  $T_g$  made into powders. Figure shows XRD data of thin film showed similar hollow peak.

**Keywords:** Amorphous, Bulk Metallic Glass, Sputtering Process, Coating Film

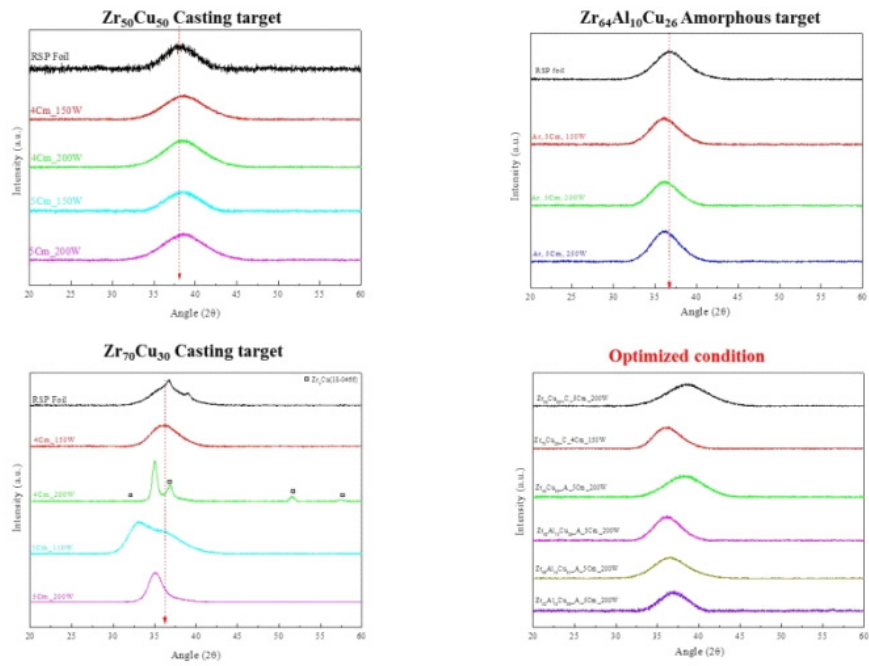


Figure. XRD diffraction spectrum of Zr-Cu and Zr-Cu-Al alloy coating film.