Production and welding of a La-based metallic glass

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The high cooling rate needed to produce bulk metallic glasses by casting limits their size to the millimeter or centimeter scale. One way to overcome this limitation is weld different parts in order to obtain a product with larger size. Nevertheless, several problems may arise during welding as partially crystallization, embrittlement, formation of defects, etc. Our research group at DEMa-UFSCar has recently developed a thermomechanical method to weld metallic glasses, where an electric current passes through the samples, which are pushed together, heating the interface between them up to the supercooled liquid region. This promotes the welding by a diffusion-controlled process at the interface. The influence of the different process parameters and different metallic glass compositions in the quality of the weld still need to be investigated. Considering this, the present work aimed to produce and weld $La_{62}Al_{14}(Cu_{5/6}Ag_{1/6})_{14}Ni_5Co_5$ metallic glass using this thermomechanical method. For this, 1.5 mm thickness plate and 1 mm diameter rods were produced and welded. The samples before and after welding were characterized by X-ray diffraction (DRX), optical (MO) and scanning electron (SEM) microscopy and differential scanning calorimetry (DSC). It was observed using SEM that the as-cast samples already presented nanometric-sized crystals. The welded samples show a variability in the quality of the welding obtained but most of the samples did not completely welded. In addition, some samples presented a higher concentration of crystals in the welded region, which suggests that these samples were heated above the crystallization temperature of the glass.

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