

Microstructural characterization of $\text{Ni}_{57}\text{Nb}_{33}\text{Zr}_5\text{Co}_5$ metallic glass

Siriwan Dulnee^{1*}, Michael Joseph Kaufman², Piter Gargarella¹, Cláudio Shyinti Kiminami¹

¹*Departamento de Engenharia de Materiais, Universidade Federal de São Carlos,
Rod. Washington Luís Km 235, 13565-905, São Carlos, Brasil*

²*Colorado School of Mines, 1500 Illinois St., CO 8040, Golden, USA*

**s.dulnee@gmail.com*

The $\text{Ni}_{57}\text{Nb}_{33}\text{Zr}_5\text{Co}_5$ metallic glass is a promising alloy to be used as bipolar plates in proton exchange membrane (PEM) fuel cells. It is important to know which phase forms in this alloy under different cooling rates in order to investigate its influence in the thermal stability and mechanical properties of this alloy. In this work, different rapid solidified samples were prepared and their phase formation and microstructure was investigated by X ray diffraction (XRD), differential scanning calorimetry (DSC), optical microscopy, scanning and transmission electron microscopy (SEM). It was observed that in the samples with the highest cooling rate (ribbons) a fully glassy structure is obtained. For the lower cooling rate samples (ingot, 2mm and 3 mm diameter rods) an complete crystalline structure forms with the presence of the equilibrium phases $\text{Ni}_3(\text{Nb,Zr})$ and Nb_7Ni_6 phases as primary phase or in an eutectic structure. For the samples with an intermediate cooling rate (1 mm diameter rods) a polymorphic solidification occurs. Crystals of a metastable phase with spherical morphology precipitates in a glassy matrix with virtually the same composition and the spherical morphology is connected with the absence of constitutional undercooling during solidification.