SESSION 7: OTHERS, SALON F

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Microstructural evolution of Ni–Mn–Ga microwires during the melt-extraction process

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ABSTRACT

Small size Ni–Mn–Ga microwires have numerous potential applications in micro-sensors and actuators. Here, polycrystalline Ni–Mn–Ga microwires with a diameter of 35–80 μm and length of 3–20 cm were fabricated using a melt-extraction technique. The microstructural evolution of the microwires during the process was evaluated in detail. Such melt-extracted microwires have a semicircular cross-section with a flattened side giving an arc-chord length ratio varying from 1.8 to 3.6. Nucleation occurred on the flattened side that was in contact with the copper wheel, with columnar grains growing towards the semicircular surface. Fine equiaxed grains (0.4–2 μm) were observed at the nucleation sites. With an increase in the copper wheel temperature, two symmetric nucleation sites may appear on the flattened surface, accompanied by a decrease in the arc-chord length ratio. Unique grain growth behavior was observed along the radial direction with columnar grains initially growing along the crystal $\langle 001 \rangle$ direction with a fan-like texture and then gradually evolving into $\langle 001 \rangle$ direction in perpendicular to the flattened surface in the late stage of crystallisation. Such grain structure and texture may favour the magnetic-field-induced strain (MFIS) in Ni–Mn–Ga microwires.

KEYWORDS: Ni–Mn–Ga alloys, melt-extraction method, nucleation behavior, grain structure, texture