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# Giant magnetocaloric effect in a Heusler $\text{Mn}_{50}\text{Ni}_{40}\text{In}_{10}$ unidirectional crystal

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## ABSTRACT

Growing Heusler Mn–Ni–In unidirectional crystals is challenging. In the present work, a modified zone-melting method has been developed on the basis of traditional optical floating zone furnace, and high-quality  $\text{Mn}_{50}\text{Ni}_{40}\text{In}_{10}$  unidirectional crystal has been produced in 0.8-MPa high-pressure atmosphere. Experimental results showed that the produced unidirectional crystal underwent a magnetic transition in austenite, followed with a martensitic transformation from a ferromagnetic austenite to a ferromagnetic martensite upon cooling. Under a magnetic field change of 30 kOe, the total effective refrigeration capacities ( $\text{RC}_{\text{total}}$ ) reached as high as 231.58 J/kg, when the magnetic field was applied along parallel to the crystal growth direction, or 246.79 J/kg when the magnetic field was applied along perpendicular to the crystal growth direction. It was suggested that this unidirectional crystal growing technique may provide an effective approach to enhance the magnetocaloric effect of Mn-rich Heusler materials.

**KEYWORDS:** single crystal growth, Heusler Mn–Ni–In, magnetocaloric materials, shape memory alloy