

Coexistence of normal and inverse magnetocaloric effects in antiferromagnetic TiFe_2 Laves phase

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Laves phase intermetallics are of significant interest due to their diverse magnetic properties and potential for magnetic refrigeration applications [1]. This study investigates the magnetocaloric effect (MCE) in the $C14$ hexagonal compound TiFe_2 (space group $P6_3/mmc$, no. 194) [2]. Polycrystalline samples were synthesized via arc melting, with magnetic characterization revealing an antiferromagnetic transition at a Néel temperature of $T_N = 278 \pm 1$ K. Based on isothermal magnetization data, the compound demonstrates a coexistence of normal and inverse MCE. Under a magnetic field change of 5 T, the inverse MCE dominates with a peak isothermal entropy change ($|\Delta S_M|$) of 0.130 ± 0.001 J kg⁻¹K⁻¹ at 270 ± 1 K, while the normal MCE reaches 0.072 ± 0.01 J kg⁻¹K⁻¹ at 297 ± 1 K. Interestingly, despite the higher entropy change of the inverse effect, the relative cooling power (RCP) is significantly higher for the normal MCE (≈ 8 J kg⁻¹) than for the inverse effect (≈ 4 J kg⁻¹). Although the overall MCE magnitude is modest, the transition's proximity to room temperature positions TiFe_2 as a viable template for optimizing magnetocaloric properties through chemical substitution.

References:

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