

Strong Enhancement of In-field Critical Current Density at 20K in MgB₂ with Minute Additions of Dy₂O₃ and B₄C

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Abstract - Minute additions of a combination of Dy₂O₃ and B₄C have been used to enhance both pinning and upper critical field in MgB₂ to the level suitable for MRI applications at 20 K. A delicate balance of Dy₂O₃ and B₄C additions is required to improve pinning without significantly reducing connectivity between grains. The Dy₂O₃ nanoparticles react with B to form 10-15 nm DyB₄ nanoparticles, while B₄C supplies carbon into MgB₂ crystal lattice and increases the upper critical field. The optimum level of Dy₂O₃ and B₄C additions is ~0.5 wt. % of Dy₂O₃ and 0.04 wt. % of B₄C, yielding a J_c (20K) of 10^5 A.cm^{-2} at 2.7 T.

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