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Progress on Boron synthesis technique through precursor modification for introduction of artificial pinning centers in MgB₂ wires

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The aim to improve critical properties of MgB₂ is crucial for its future application. Introduction of artificial pinning center (APC) in MgB₂ will be a key factor for enhancement of critical current density. Here we report the progress on synthesis of boron precursor prepared following a patented process developed at SPIN-CNR laboratories. Basic idea is manipulate B precursor B₂O₃ in liquid phase (water solution) where it is possible to introduce homogeneous dopants by dispersion. Solution is sprayed in liquid nitrogen and freeze-dried to remove water and keep homogeneous dopant distribution.

Dopants must be soluble in water and resist to hydrolysis up to about 80-100 °C, with a large pool of possible candidates. We report a systematic study on the effect of poly-saccharide at different concentrations on MgB₂ and interaction of C-rich aggregates with surrounding lattice. BN, CaF₂, ZrO₂ and TiO₂ were used as dopants by preparing a stable suspension of these ceramic materials and their effects on critical properties and morphology are reported. Chlorides of transition metals (Zr, Ti, Y) were investigated for the possibility to introduce nanometrical binary borides coherently with MgB₂ lattice, useful as effective pinning centres.

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