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Influence of ZnO and Dy₂O₃ on MgB₂ Bulks Fabricated by High Temperature and Pressure Reaction

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Recently, ZnO and Dy₂O₃ have been considered as dopants for the improvement of superconducting properties in MgB₂ bulks. However, the effect of these dopants is still unclear: some studies reported these metal oxides worked as new pinning centers and others was attributed the effects to Mg site substitution. In addition, low temperature reactions may explore limited solubility regimes for these dopants. In order to study the intrinsic effect of ZnO and Dy₂O₃ in MgB₂, a high temperature sintering method has been used to fabricate dense and homogeneous MgB₂ bulks. To do this we used an induction furnace built inside of a high pressure vessel which allowed us to reach 1700oC and 1500 Psi. A slow cooling rate (2oC/min) was used in an attempt to obtain a homogeneous nucleation and phase distribution. A series of MgB₂ bulk samples with ZnO and Dy₂O₃ additives were synthesized through this high pressure and temperature procedures. The resulting microstructures of these bulk samples were revealed by SEM and TEM. Atomic substitution were evaluated by high resolution XRD. The upper critical field B_{c2}, irreversible field B_{irr} and T_c were obtained from both magnetic and resistivity measurements. The roles of substitution vs precipitate induced strain on B_{c2} enhancements with adding ZnO and Dy₂O₃ were discussed.

Primary author: YANG, Yuan (OSU)

Co-authors: Prof. COLLINGS, Edward (The Ohio State Univerisity); SUMPTION, Mike (The Ohio State University)

Presenter: YANG, Yuan (OSU)

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