Towards the development of a high quality doped boron precursor and the effect on the superconducting properties of MgB$_2$


— Gas phase plasma synthesis techniques were used to produce nano-sized doped boron powder from vapor phase precursors. The powders were reacted with magnesium to make MgB$_2$. The measurement of the resultant superconducting properties suggests that boron made by this synthetic method may result in MgB$_2$ superconductors with enhanced critical currents and upper critical fields. The values of $J_c$ and $H_{c2}$ obtained using plasma synthesized boron precursors are compared with those values for MgB$_2$ obtained using crystalline and amorphous boron powder made by other techniques, as well as boron fiber made by chemical vapor deposition. The roles of processing temperature and time, particle and grain size, purity, dopant concentration, and chemical homogeneity are evaluated in terms of their relative effects on the critical current and upper critical field of MgB$_2$. 

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