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Significant Enhancement of Bc2 at 20-25 K for MgB2 Thin Films via Controlled oxygen doping

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Various dopants have been investigated for increasing Bc2 in MgB2. Most of these have not been beneficial, with the exception of C or C-bearing materials (increasing 4 K Bc2) and Dy2O3 (at higher temperatures). While Bc2 approximately doubled with C additions at 4.2 K, the high Bc2 results of the thin films have not been replicated in wires. Hence we re-investigate oxygen additions, with a focus on controlled oxygen addition for Bc2 increase. By diffusing O into PLD-made MgB2 thin films, we have successfully prepared a series of O-doped MgB2 thin films with different O concentrations. XRD shows a peak shift with the increase of O doping levels. The oxygen doping is controllable, generating a reproducible peak shift which is correlated with a significant increase in Bc2. The temperature at which Bc2 = 14 T is pushed up from 14 K to 21 K. Indeed, Bc2 is increased over the whole temperature range from 15 K to 30 K, and presumably is increased at lower temperatures as well. We also describe our efforts to realize oxygen doping in wires and the results of these measurements.

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