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COMPLEX BEHAVIOR OF MAGNESIUM DIBORIDE FILMS IN HALL MEASUREMENTS AND FAR-IR OPTICAL TRANSMISSION STUDIES. H.M. Christen, H.Y. Zhai, M. Paranthaman, D.K. Christen, R. Jin, C. Cantoni, D.G. Mandrus, J.R. Thompson, H.R. Kerchner, B.C. Sales, and D.H. Lowndes, *Oak Ridge National Laboratory, Oak Ridge, TN, USA*, R.A. Kaindl, M.A. Carnahan, and D.S. Chemla, *Lawrence Berkeley National Laboratory, Berkeley, CA, USA.*

Studies of the newly discovered superconductor MgB_2 benefit from the availability of thin films grown by various methods onto a variety of substrates. We present results on films obtained by an ex-situ reaction of e-beam evaporated boron films and by an in-situ post-anneal of pulsed-laser deposited precursor layers. Transport measurements on ex-situ processed films with bulk-like $T_c \approx 39$K exhibit an irreversibility line that exceeds that determined by magnetic measurements on bulk materials. Hall measurements at various temperatures and magnetic fields show that in the normal state, MgB_2 behaves similarly to the high-T_c cuprates: $R_H \propto T$ and $\cot\theta_H \propto T^2$, and a sign reversal of R_H is observed in the mixed phase. Furthermore, far-infrared transmission studies reveal a gap 2Δ about one half of that expected from BCS theory. These results impose severe constraints on proposed simple descriptions for this novel superconductor. Careful analysis and comparison of films obtained by different methods provide insight to the growth mechanisms at play, and point out the challenges in the growth of MgB_2 at elevated temperatures.

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