MAGNESIUM DIBORIDE FILMS FOR SRF CAVITY APPLICATIONS

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Abstract

We have explored magnesium diboride films for applications in SRF cavities. MgB_2 has a high T_c = 40 K and low surface resistance that, even in polycrystalline films, is comparable to niobium. It also shows the potential for higher power handling than niobium because of the higher critical fields. We report the results of measurements of the surface resistance and power handling in films deposited by the reactive-evaporation method. The measurements were made using both a stripline-resonator at 2 GHz and with a dielectric resonator at 10.7 GHz. The best results for surface resistance are 14 micro-ohm at 10.7 GHz, which scales to 0.5 micro-ohm at 2 GHz. The maximum rf magnetic field of the best film has been measured to be 300 Oe, limited by the available amplifier. We have also demonstrated a successful surface-passivation method of atomic-layer-deposited (ALD) films of Al_2O_3 and Zr_{O2}. We have also demonstrated evidence that one of the two energy gaps shows unconventional symmetry with a six-fold-symmetric nodal order parameter. The implications for applications of these findings of the basic physics of the material will be discussed.

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