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Josephson and Multi-Gap Quasi-Particle Tunneling in Crystalline MgB_2-based Junctions with an MgO Sputtered Barrier[1] JEAN-BAPTISTE LALOE, MIT, J. S. MOODERA, SCTF TEAM — MgB_2 is a multi-gap superconductor with a T_C of 39K and a hexagonal structure. This simple and stable compound is very attractive for device applications. We have deposited and patterned micron-sized SIS tunnel junctions with highly textured MgB_2 electrodes grown by MBE co-evaporation with sputter-deposited MgO tunnel barriers, in an entirely in-situ process. This method enabled us to obtain low resistance junctions with very good oxide coverage. We present $I-V$ and dI/dV data displaying Josephson pair tunneling as well as the quasi-particle tunneling signature of both the Pi- and Sigma-bands of the MgB_2. Our experimental gap values agree with theoretical calculations. Although our MgB_2 films were c-axis oriented, growth-related roughness of the bottom MgB_2 enable a/b-axis tunneling and thus explain the observed Sigma-band features. We link our data to a simple model assuming tunneling to occur from both the Pi- and Sigma-bands in parallel, proportionally weighted depending on the interfacial topography.

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