The crystalline layered high-Tc superconductor Bi-2212 can be easily cleaved into smoothly faceted flakes, which, when placed into intimate physical contact with a variety of layered materials or bulk semiconductors, form heterogeneous junctions.

Two such junctions are discussed in this talk: Bi-2212/IT-TaS$_3$, where at low temperatures, the 1T-TaS$_3$ is a Mott insulator harboring charge density waves (CDWs) and Bi-2212/$n$-GaAs Schottky barrier junctions, which manifest quantum mechanical tunneling at low bias voltages. The CDW order in the 1T-TaS$_3$ appears to play an important role by coexisting with an unexpected and surprisingly high Tc of the induced proximity gap which, for junctions with high transparencies, is seen to have a surprisingly large value ($\approx 20$ meV) equal to half that of intrinsic Bi-2212 ($\approx 40$ meV). Proximity-induced high-Tc superconductivity in the 1T-TaS$_3$ is driven by coupling to the metastable metallic phase coexisting within the Mott commensurate (CCDW) phase and associated with a concomitant change of the CCDW order parameter in the interfacial region. For the Bi-2212/$n$-GaAs Schottky barrier junctions, modifications to the thermionic emission equation provide an excellent description of the I-V characteristics even at low temperatures where tunneling is found by differential conductance spectroscopy measurements to be important and capacitance measurements under reverse bias suggest an unexpectedly long electric field screening length in the superconductor.