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Tunneling spectroscopy in metal-hexagonal boron nitride-graphene structures[1] U. CHANDNI, Institute for Quantum Information and Matter and Department of Physics, California Institute of Technology, Pasadena, California 91125, USA, K. WATANABE, T. TANIGUCHI, National Institute for Materials Science, 1-1 Namiki, Tsukuba Ibaraki 305-0044, Japan, J. P. EISENSTEIN, Institute for Quantum Information and Matter and Department of Physics, California Institute of Technology, Pasadena, California 91125, USA — Tunneling spectroscopy provides a tool to probe the density of states of various electronic materials. Here, we report vertical tunneling transport in van der Waals heterostructures with hexagonal boron nitride (hBN) as a tunnel barrier between graphene (or graphite) and a metal (Cr/Au) electrode. We observe a strong suppression of tunneling at low biases, with a gap of about 130 meV in the dI/dV spectrum for metal-hBN-graphene (or graphite) structures. In the graphene devices, the finite zero-bias tunnel resistance was found to depend on the electron density of the graphene layer, while the gap remained unaffected. We also tested graphite-hBN-graphite junctions, in which the strong suppression of tunneling at low energies was found to be absent. We interpret the signatures in the context of phonon-mediated processes in such vertical heterostructures.

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