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Tunnel current in junctions involving disordered *d*-wave superconductors with charge density waves

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We calculated the quasiparticle tunnel current either between two identical layered *d*-wave superconductors partially gapped by charge density waves (CDWs) (like, e.g., in cuprate mesas) or between a *d*-wave superconductor with CDWs and a normal metal (as in the scanning tunneling spectroscopy regime). The cases of stripe-like and checkerboard CDWs, which were detected in various high-T_c oxides, were analyzed. In the both junction geometries (symmetric and nonsymmetric), the *c*-axis in the superconducting electrode(s) was assumed to be directed normally to the junction plane, and the incoherent current flow mode was adopted. The resulting tunnel conductance dependences on the bias voltage, $G(V)$, were found to possess a number of sharp singularities induced by both superconducting and CDW gap features. The electrode inhomogeneity (e.g., nonstoichiometry) treated as a spread of the "parent" CDW order parameter was shown to smear those peculiarities (especially the CDW-driven ones) and transform them into bumps. The results are in a qualitative agreement with the experimental data obtained by scanning tunnel spectroscopy, intrinsic tunneling, and break-junction measurements for a number of cuprates. It was shown that in the symmetric configuration (e.g., break junctions), the $G(V)$ peculiarities may be rather robust against the temperature-induced smearing. On the contrary, a high smearing of the CDW-related $G(V)$ features observed for cuprates at both low and high temperatures testifies that the spread of gap values occurring due to the intrinsic spatial inhomogeneity in nonstoichiometric oxides is very important.