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Resistance anomaly in superconducting films containing disordered arrays of holes Z.L. XIAO[1], J. HUA, U. PATEL, D. ROSENMANN, U. WELP, W.K. KWOK, G.W. CRABTREE, Argonne National Laboratory —
Anomalous resistive peaks with values larger than the normal-state resistance has been observed in the resistance versus temperature and magnetic field curves of superconducting nanostructures of Al nanowires, nanoloops and nanodiscs. The excess resistance in these systems is believed to originate at the normal-superconducting ($N-S$) interface and induced by dynamic phase slip centers or by different critical temperatures (Tc) in the neighboring parts. Here we report on a new type of resistance anomaly which occurs only at high driving currents in disordered superconducting films. The samples were formed by sputtering niobium onto substrates containing arrays of irregularly distributed nanoscale holes. Resistance peaks appear as a function of temperature or magnetic field in the superconducting transition, with peak values up to 2% above the typical normal-state value. We attribute the observed resistance peak effect to dissipation-induced granularity which enhances contributions from the fluctuation-induced decrease of the quasiparticle density of states. The granularity of the superconducting film arises from inhomogeneous heat-transfer due to the size variation of the Nb sections between the nanoholes.

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