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Excess current noise in electrically conductive, crack-free, nanopatterned films of semiconductor nanocrystals TAMAR MENTZEL, University of California at Berkeley, NIRAT RAY, DARCY WANGER, MOUNGI BAWENDI, MARC KASTNER, MIT — We present the first electrical measurements of semiconductor nanocrystal films that have nanoscale dimensions and are crack-free. These films make it possible to study the electrical properties intrinsic to the nanocrystals unimpeded by defects such as cracking and clustering that typically exist in larger-scale films. The films' dimensions are as small as 30 nm and are positioned on a surface with 30 nm precision. The electrical conductivity of the crack-free nanoscale films is 180 times higher than that of drop-cast, microscopic films made of the same type of nanocrystal. In the nanoscopic patterns, we find excess noise in the current that is thermally activated. This noise is unusual in that it is of a comparable order of magnitude to the average current, and both the average current and the noise fluctuate by several orders of magnitude in time. The noise increases with an applied field and with a gate. The inability to explain these effects by commonly known origins of electrical noise suggests that we are observing a novel effect in the nanocrystals.

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