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The role of micro-shorts and electrode-film interface in the electrical transport of ultra-thin metallophthalocyanine capacitive devices[1]
CARLOS MONTON, ILYA VALMIANSKI, IVAN K. SCHULLER, Department of Physics and Astronomy, University of California San Diego, 9500 Gilman Dr., San Diego, La Jolla, CA 92093, U.S.A — The transport properties of metallophthalocyanine thin films are of much basic interest and are important ingredients in many technological applications. Ohmic conductance Co-phthalocyanine (CoPc) of thin film (15 nm to 90 nm) capacitive devices has been investigated in the 40K to 300 K temperature range. For Pd and V electrodes, the electrode-film (E-F) interface and metallic micro-shorts contribute substantially to the conductance with decrease CoPc layer thickness. A quantitative model which describes the E-F interface, CoPc roughness, micro-shorts, and the exponential temperature and thickness dependence of conductance was developed. Parameters obtained from this model are in good, quantitative agreement with independent measurements. The model predicts a 15-20 nm lower limit for capacitive device thickness, below which the conduction is mainly controlled by shorts. In this regime, small changes in mean CoPc thickness result in drastic variation in device conductance.

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