Abstract Submitted
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Electric field gating near the metal-insulator transition using ionic liquid dielectrics[1] ARTHUR HEBARD, RAJIV MISRA, MITCHELL MCCARTHY, University of Florida — Ionic liquids (ILs) are highly polar low-melting-temperature binary salts typically comprising nitrogen-containing organic cations and inorganic anions. Since there is no solvent, ILs are distinctly different from aqueous, organic, gel or polymer electrolytes. Using either coplanar or overlay gate configurations in which the IL is the gate dielectric, we demonstrate room temperature field-induced resistance changes on the order of a factor of 10^4 for thin conducting InOx films. There is a large asymmetry manifested by the significantly larger changes in impedance for negative gate voltage V_g (electron depletion) compared to positive V_g (electron enhancement). The pronounced frequency dependence over the range 10^{-2}–10^6 Hz, due to the low ionic mobilities in the dielectric fluid, is modeled well by a simple RC circuit from which an effective areal gate capacitance can be derived. The induced surface charge densities and field-effect mobilities noticeably exceed those that can be achieved on similar films using AlOx dielectrics. In addition, the charge state can be frozen in by reducing the temperature below the glass transition (~250K) of the IL, thus providing an opportunity for electric field tuning of metal-insulator transitions in a variety of novel thin-film systems.

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