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Charge injection and transport in a single organic monolayer island

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We report how electrons and holes, that are locally injected in a single organic monolayer island (where organic monolayers are made from sublimated oligomers (pentacene and other oligoacenes), or made from chemisorption in solution (self-assembled monolayers) of pi-conjugated moieties), stay localized or are able to delocalize over the island as a function of the molecular conformation (order vs. disorder) of this island. Charge carriers were locally injected by the apex of an atomic force microscope tip, and the resulting two-dimensional distribution and concentration of injected charges were measured by electrical force microscopy (EFM) experiments. We show that in crystalline monolayer islands, both electrons and holes can be equally injected, at a similar charge concentration for symmetric injection bias conditions, and that both charge carriers are delocalized over the whole island. On the contrary, charges injected into a more disordered monolayer stay localized at their injection point. These different results are discussed in relation with the electrical performances of molecular devices made from these monolayers (OFET, SAMFET). These results provide insight into the electronic properties, at the nanometer scale, of these molecular devices.