Electrostatic doping is a strong tool for controlling carrier concentration at two-dimensional interfaces. Field effect transistors (FETs) and electric double layer transistors (EDLTs) are now being applied for many thin layer materials that exhibit electric-field induced superconductivity. Larger lattice size of molecular conductors makes it even much easier to find superconductivity switching by electrostatic doping, because the low carrier concentration allows larger degree of band filling tuning at a given gate voltage. Strongly correlated two-dimensional molecular conductors are attractive materials for seeking such an electric-field induced superconductivity because of their rich phase diagram, low carrier concentration, and lattice softness. We have been developing electronic devices based on thin layer single crystal of organic Mott insulators, or k-type BEDT-TTF salts, to realize such a field induced switching of superconductivity (BEDT-TTF = bis(ethylenedithio)tetrathiafulvalene). This technique will contribute not only to elucidate the phase diagram of strongly correlated molecular conductors but also to find a new material for superconductivity. In this presentation, direct switching of superconductivity by gate electric field, one-dimensional strain, and/or light-irradiation will be discussed.

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