**Photo-induced superconductivity in κ-(BEDT-TTF)$_2$Cu[N(CN)$_2$]Br utilizing a photo-active electric double layer**

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Manipulating the electronic phases of a condensed matter by external stimuli is one of the hottest topics in the field of modern electronics. Strongly-correlated materials are good candidates for such phase transition devices. Recently, we have demonstrated a field-induced superconductivity in κ-(BEDT-TTF)$_2$Cu[N(CN)$_2$]Br (κ-Br). This is the first observation of field-induced superconductivity in an organic field-effect transistor [1]. In this study, we fabricated novel photo-active superconducting devices by laminating κ-Br on Al$_2$O$_3$/Nb-SrTiO$_3$ substrates coated with self-assembled monolayer of spiropyran-derivatives (SP-SAM) [2]. Because of the weak tensile strain-effect from the substrate, the initial resistances for the devices showed insulating properties. After UV irradiation, however, superconducting transition at 7.4 K was clearly observed, and remained even after the irradiation was stopped. The resistance recovered to nearly the initial value by visible light irradiation, showing a reversible switching capability. From our previous measurements, κ-Br is known to evoke superconductivity by electrostatic carrier doping. The above reversible switching of superconductivity should also be due to a carrier doping by the formation of electric-double-layer (EDL) at the interface. Spiropyrans can switch between a non-ionic isomer and a zwitterionic isomer when triggered by light-irradiation with different wavelengths, resulting in a significant change in the electric dipole moment. Reversible changes in dipole moment of SP-SAM produced two distinct electric fields between the κ-Br and the substrates that created electrostatically doped carriers. Thus, superconductivity could be switched by photo-irradiation by photo-induced EDL formation.