Optical and low-temperature transport properties of an organic conductor with disordered anion structure κ''-$(ET)_2Cu[N(CN)_2]Br$

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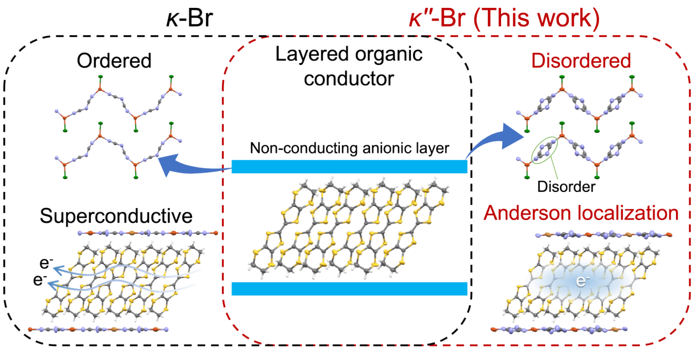
The organic conductors κ-$(ET)_2X$ have been known as highly correlated electronic systems where a superconducting phase is located in the vicinity of a Mott-insulating phase.[1] Recently, the effect of structural disorder in κ-$(ET)_2X$ has attracted much attention. For example, X-ray irradiation induces lattice defects, leading to a disorder-induced metal–insulator transition in the superconducting κ-$(ET)_2Cu[N(CN)_2]Br$ (**κ-Br**)[2] and the suppression of long-range magnetic order in the Mott-insulating κ-$(ET)_2Cu[N(CN)_2]Cl$ (**κ-Cl**).[3] However, the destructive X-ray irradiation may also induce secondary effects such as carrier doping due to ionization and local modulation of Coulomb interactions.[4] To elucidate the intrinsic effect of a random potential, a nondestructive method such as chemically-introduced/controlled disorder in the anion layer while keeping the ordered conducting ET layer is desirable.

Recently, we succeeded in synthesizing κ''-$(ET)_2Cu[N(CN)_2]Br$ (**κ''-Br**), which is the first polymorph of **κ-Br**, having very similar conducting ET layers but disordered insulating anion layers in contrast to those of **κ-Br**. It was found that the **κ''-Br** is neither a conventional superconductor nor a Mott insulator, but the detailed electronic states remained unclear. In this study, we investigated the ground state of **κ''-Br** from the results of reflectance spectroscopy, Raman scattering spectroscopy, and low-temperature resistivity behavior obtained by using a high-quality single crystal of **κ''-Br** which is free from crystal twinning or magnetic impurities. Our results suggest the occurrence of Anderson localization in **κ''-Br** due to disordered anion layers.



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