Reentrant Mott transition from a Fermi liquid to a spin-gapped insulator in the organic S-1/2 triangular-lattice antiferromagnet

Yasuhiro Shimizu, Akiko Tajima and Reizo Kato

RIKEN, Wako, Saitama, 351-0198 Japan

Pressure-induced Mott transition and superconducting transition in the triangular-lattice antiferromagnet, $EtMe_3P[Pd(dmit)_2]_2$, are presented. This material has a nearly isotropic triangular lattice of the $Pd(dmit)_2$ dimer with spin-1/2, expected from the calculated transfer integrals and the temperature dependence of the magnetic susceptibility at ambient pressure. The magnetic ground state settles into a spin gap phase accompanied with the lattice distortion at 25 K. By applying a hydrostatic pressure, we have observed the Mott transition with a four-order-magnitude resistance drop at 20 K. In addition, the reentrant metal-insulator transition occurs around 10 K, followed by a superconducting transition at 5 K. An application of magnetic field suppresses the reentrant Mott transition. The result manifests the presence of the spin gap in the low-temperature insulating phase, which is diminished by the magnetic field and displaced by the metallic phase. We show the pressure-temperature phase diagram: the spin-gapped Mott insulating phase neighbors to the superconducting phase.