An Interlayer Magnetoresistance Peak Effect below Superconducting Transition Temperature in $Et_2Me_2P[Pd(dmit)_2]_2$

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Interlayer transport in some two-dimensional superconductors, such as high T_C superconductors and κ-ET_2X salts, show interesting field dependent magnetoresistance peak below superconducting transition temperature T_C. Many results suggest that this peak effect is intrinsic to the layered systems. Several models, including a stacked Josephson-junction model, have been proposed to explain this magnetoresistance peak effect. The origins, however, still remain controversial. To investigate the mechanism of this interlayer magnetoresistance peak effect, we carried out magnetoresistance measurements for a pressure induced superconductivity in an anion radical salt β'-$Et_2Me_2P[Pd(dmit)_2]_2$.

β'-$Et_2Me_2P[Pd(dmit)_2]_2$ is known to exhibit an insulating behaviour that can be easily suppressed by application of pressure. Close to the critical pressure (P_C) where the non-metallic behaviour is completely suppressed, a superconducting state appears below 4 K. Interlayer magnetoresistance measurements with the field parallel to the current direction were carried out on single crystals of β'-$Et_2Me_2P[Pd(dmit)_2]_2$ under high pressure. Measurements were performed at pressure of 0.59 GPa (slightly lower than P_C) and 0.71 GPa (higher than P_C). A superconducting state was observed at each pressure.

At the pressure of 0.59 GPa, the magnetoresistance was found to display a pronounced peak as a function of magnetic field below T_C = 3.1 K. At 0.71 GPa, the magnetoresistance peak was also observed below T_C = 3.0 K, however, the observed magnetoresistance peak was much smaller than that at 0.59 GPa. This pressure effect is probably due to a change of effective Josephson-junction area caused by a change of superconducting volume fraction.