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Physical properties of a carrier doped [Ni(dmit)$_2$] molecular spin ladder

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The ladder type S = 1/2 antiferromagnetic spin lattice systems are interested in material science. Particularly, an even-leg antiferromagnetic spin ladder has been attracting extensive interest because they are expected superconducting transition upon carrier doping from recently theoretical studies. In fact, hole-doped spin ladders of copper-oxide based materials showed superconducting transition under high pressure[1],[2].

On the other hand, we have succeeded in constructing a possible molecular spin ladder, [Ph(NH$_3$)]([18]crown-6)[Ni(dmit)$_2$][3],[4]. The magnetic susceptibilities data of the salt show a broad maximum at 120 K, and reached 0 emu・mol^{-1} around 15 K. The magnetic susceptibilities below 80 K were well fitted by the low-temperature limit equation of two-leg spin ladder with the spin-gap Δ/k_B of 190 K. As a next step, the carrier doping into the spin ladder by utilizing supramolecular system has been already tried. Specifically, a neutral supramolecular structure [(PhNH$_2$)([18]crown-6)] which has same shape as supramolecular cation [(PhNH$_3$)([18]crown-6)]$^+$ was introduced in the crystal as holes. The obtained doping salt indicated about 10,000 times smaller resistivity than the pristine salt at room temperature. Moreover a single-crystal diffraction measurement reveal that the unit cell parameters of the doped salts are the same as those of pristine salts. The physical properties of doped salts will be presented in details.

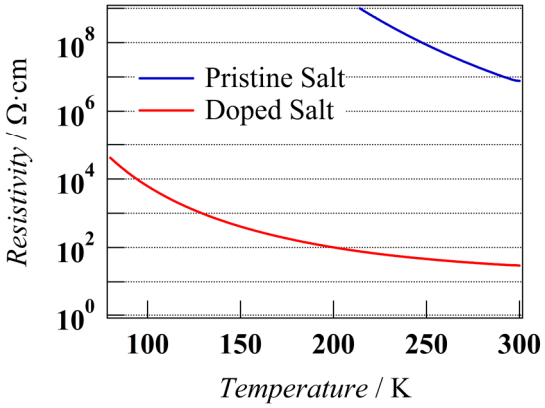

Fig.1 Resistivity of pristine and doped salts

References

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