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Synthesis and Physical Properties of New Iridium Oxyfluorides Using Topochemical Reaction Method

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Ruddlesden-Popper (RP) type Iridate Sr_2IrO_4 has been paid much attention due to the interesting physical properties such as J_{eff} = 1/2 Mott insulating state induced by strong spin-orbit interaction[1]. Moreover, the possibilities of unconventional superconductivity in carrier-doped Sr_2IrO_4 has been proposed because it has several similarities with the high-T_c cuprate superconductors such as La_2CuO_4[2]. Carrier doping such as La substitution for Sr site was already attempted[3], but bulk superconductivity has not yet been reported. So far, we have reported synthesis of new iridium oxyfluoride $Sr_2Ir(O,F)_{6-\delta}$ using topochemical reaction method. This compound has more anisotropic structure due to insertion of fluorine layer into rock salt layer, and suppression of the magnetic ordering in Sr_2IrO_4 have been observed with topochemical fluorination. Thus, we utilized topochemical reaction method for other iridates in order to synthesize a novel iridium oxyfluorides.

Ba_2IrO_4 as precursor was synthesized by a conventional solid-state reaction method under high-pressure. Thereafter, it was mixed with various fluorinating argents such as ZnF_2, CuF_2 and PTFE (precursor : fluorinating agents = 1 : 1), and the mixture was heated at 250-550 °C for 12 hours in air. Phase identification was performed by powder X-ray diffraction method. Magnetic susceptibility and resistivity were measured using a SQUID magnetometer and a four-probe method. The valence state of Ir ion was evaluated using XAFS study.The figure shows powder XRD pattern of the compounds and the possible crystal structure. New layered iridium oxyfluoride $Ba_2Ir(O,F)_{6-\delta}$ was successfully synthesized by topochemical fluorination with ZnF_2, CuF_2 and PTFE. This oxyfluoride has the same structure as $Sr_2Ir(O,F)_{6-\delta}$ with largely enhanced *c*-axis length because fluorine layer was inserted in the rock salt layer. The magnetization measurements showed paramagnetic behavior after fluorination. Meanwhile, the electronic transport properties of $Ba_2Ir(O,F)_{6-\delta}$ exhibited semiconducting behavior like $Sr_2Ir(O,F)_{6-\delta}$. Further detail of the compounds such as valence state of Ir will be given in the presentation.

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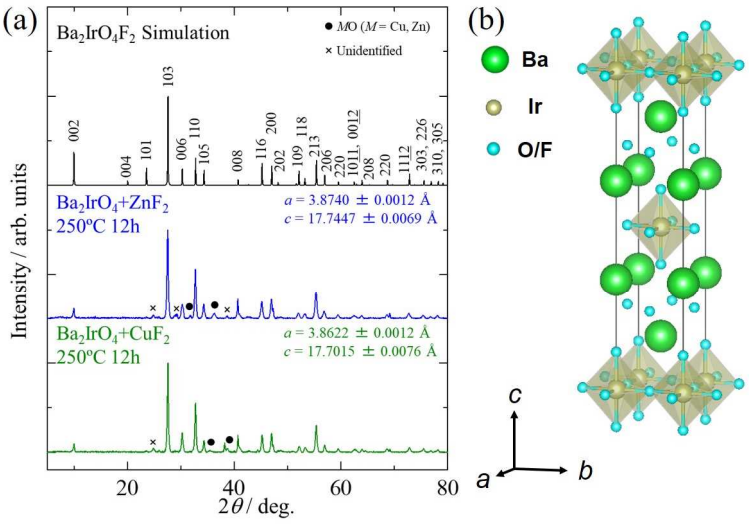

Fig. (a) Powder XRD patterns of $Ba_2Ir(O,F)_{6-d}$ and (b) Crystal structure model of $Ba_2Ir(O,F)_{6-d}$.