

Development of new inorganic materials by the layered mixed-anion perovskites

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The compounds containing more than one anionic species in a single phase, so-called mixed anion-compounds, have been considered as a new family of functional materials[1]. Especially, layered mixed-anion compounds, composed by stacks of different kind of layers forms natural superlattice, and can be regarded two-dimensional nano structures. Owing to the structure, these compounds show specific properties such as excitonic luminescence even at room temperature. Perovskite oxides are well-known family in inorganic materials. On the other hand, mixed-anion perovskites such as $\text{Sr}_3\text{Sc}_2\text{Cu}_2\text{S}_2\text{O}_5$ [2] are far less studied because of difficulties in material design of the system.

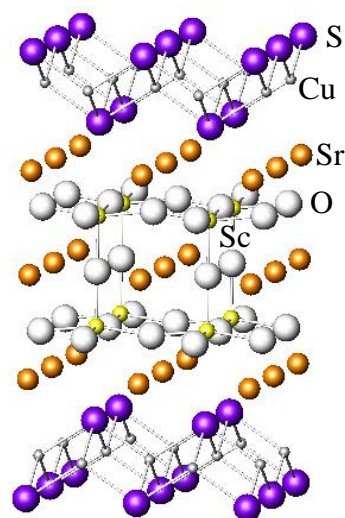
Recently we established guidelines to develop new compounds in the system. Especially, a series of mixed anion perovskites composed by stacking of semiconducting and insulating layers such as $\text{Sr}_2\text{ScCuChO}_3$ (Ch = chalcogenides) have been developed[3,4]. These compounds show sharp exciton emission peaks near the band edge, and the stability of excitons at room temperature because of quantum confinement effect owing to their layered structure. We have also discovered several related compounds, and they exhibit plenty of functionalities such as luminescence, thermoelectricity, superconductivity and so on. Chemical flexibility of the functional layer offers to tune the band gap of the compounds, and structural difference gives different level of the quantum confinement effect as well as temperature stability of the luminescence.

[1] H. Kageyama *et al.*, *Nat. Commun.* **9** (2018) 772.

[2] K. Otzchi, H. Ogino *et al.*, *J. low Temp. Physics* **117** (1999) 729-733

[3] H. Ogino *et al.*, *Appl. Phys. Lett.* **101** (2012) 191901

[4] Y. Iwasa, H. Ogino *et al.*, *Opt. Mater.* **84** (2018) 205-208



Crystal structure of layered mixed anion perovskite $\text{Sr}_3\text{Sc}_2\text{Cu}_2\text{S}_2\text{O}_5$