Mixed-anion van der Waals Materials from a Solid-State Chemistry Perspective

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Electronic correlation in quantum materials drives the emergence of exotic collective states, that cannot be explained by semiclassical particles. From low dimensional magnets and topological insulators to long sought after spin liquids or topological superconductors, this class of materials promise to play a key role in the development of next-generation quantum technologies. To guide quantum materials discovery, we emphasize the critical role of combining an advanced crystal growth of high-purity materials with a detailed structural and physical characterization in order to understand this complex materials, with often intertwined orders.

Here we particularly focus on the effect of combining different anions in low-dimensional van der Waals materials by studying two mixed-anion systems, the CrSBr magnet and the SbSI ferroelectric. CrSBr stands out as an interesting platform to enlarge the functionalities of 2D magnetic materials by combining a high magnetic critical temperature, exotic magneto-transport properties [1], and a low-temperature magnetic hidden-order [2]. On the other hand, SbSI stands as a representative *photo-ferroelectric material,* in which ferroelectricity is combined with a strong light absorption in the visible range. We show how Sb by Bi substitution allows for a progressive modulation of the ferroelectric properties toward a better performance as solar cell light harvesters.

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