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Title: Synthesis of functional organic-inorganic hybrid materials

Abstract:

The synthesis of hybrid organic-inorganic materials has generated diverse material families of varying elemental composition, framework dimensionality, and organic constituents, yielding a rich array of related material phases. For example, the selective isolation of 3D or 2D halide perovskite materials can be achieved through isovalent substitutions onto anionic metal-halide polyhedra, or to the cationic organic spacers. These investigations have revealed key synthetic parameters which can be utilized to directly tune hybrid material phases and resultant properties, including optoelectronic properties, environmental stability, and semiconducting activity. Ongoing investigations have sought to expand this phase space from the prototypical lead halide systems, seeking both transition metal analogs and novel inorganic frameworks which may yield new structure-property relationships. Recent studies have shown promise in generating new hybrid frameworks that exhibit synthetic control of inorganic dimensionality and material properties related to the organic spacer, however, they remain underexplored. Preliminary experiments have generated hybrid materials with inorganic frameworks of low dimensionality with multiple unique metal bonding coordination environments, or which contain multiple metal sites of mixed valency. Additionally, these systems are observed to display optical activity under varied illumination conditions, highlighting their potential as functional materials.