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Preface: Two dimensional (2D) hybrid organic-inorganic perovskites

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2D hybrid organic-inorganic perovskites (HOIPs) have been intensively investigated over the past 30 years before the rise of photovoltaic 3D hybrid perovskites.¹ Along with the increasing research interest on 2D materials, they have attracted much attention. On the one hand, 2D hybrid perovskites possess much improved photo- and chemical stability over their 3D counterparts.² On the other hand, the delicate interplay of multiple atomic bonding forces in the crystal lattice enables them to exhibit extraordinary properties that traditional inorganic 2D materials are unable to show.³ More importantly, the chemical and structural diversity of 2D HOIPs offers greater opportunities to fine-tune and engineer properties and functionalities compared with their 3D counterparts.³

The revival of this promising field has prompted intense research endeavour to deal with many challenging aspects. For example, layered halides are under intensive exploration to enhance the stability of state-of-the-art perovskite solar cells, but little attention has been paid to synthesize new systems beyond halides.⁴ Another direction is structural phase transitions since fully understanding their complex mechanisms would enable the discovery of some novel 2D ferroelectric and multiferroic systems.⁵ In addition, the combination of the soft lattice due to weak ionic bonding, dynamic structural nature, and inherent anisotropy of 2D hybrid perovskites would inevitably lead to unusual emergent properties and responses upon exposure to external stimulation.⁶ To address these issues, a comprehensive and interdisciplinary overview on 2D hybrid perovskites is therefore highly desired.

This special issue explores 2D HOIP materials from diverse perspectives, which integrates materials science, physics, chemistry, and engineering. Some papers discuss the fundamental chemical synthesis and molecular structures along with the optical, electric, and mechanical properties. Others also demonstrate cutting edge film fabrication and state-of-the-art computations. We believe the selected articles will not only raise research awareness of 2D materials beyond current inorganic systems but also extend the flourishing landscape of hybrid perovskites from 3D to 2D.

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