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Recent Developments in Hybrid Perovskite Halides

Hybrid organic-inorganic perovskites are found in a number of important families, including the lead-based halides (e.g. $\text{CH}_3\text{NH}_3\text{PbI}_3$) and the formates (e.g. $[(\text{CH}_3)_2\text{NH}_2]\text{Zn}(\text{HCOO})_3$) [1], as well as systems with the ReO_3 structure [2]. The lead halide perovskites have attracted a great deal of attention in the last decade on account of their excellent performance as active layers in solar cells and other optoelectronic devices. Some of our recent work has focused on the search for *lead-free* hybrid double perovskites, such as $(\text{CH}_3\text{NH}_3)_2\text{AgBiBr}_6$. We shall discuss why it has been difficult to synthesis these double perovskites as iodides [3]. We shall also describe some B-site vacant perovskites based on ruthenium [4], as well as recent developments in the area of hybrid *layered* double perovskite halides [5].

1. W. Li *et al.*, *Nature Rev. Mater.* **2**, 16099 (2017)
2. H. A. Evans *et al.*, *Nature Rev. Mater.* **5**, 196 (2020)
3. P. Vishnoi *et al.*, *J. Phys. Chem. C*, 125 11756 (2021)
4. P. Vishnoi *et al.*, *Angew. Chemie Intl. Ed. Eng.* 59, 8974 (2020); P. Vishnoi *et al.*, *Angew. Chemie Intl. Ed. Eng.* **60**, 5184 (2021)
5. L. L. Mao *et al.*, *J. Amer. Chem. Soc.* **141**, 19099 (2019); H. A. Evans *et al.*, *Ann. Rev. Mater. Sc.* **51**, 351 (2021); P. Vishnoi *et al.*, *Submitted for publication.*

Tony Cheetham is a Research Professor at the University of California, Santa Barbara, and a Distinguished Visiting Professor at the National University of Singapore. He was formerly the Goldsmiths' Professor of Materials Science at the University of Cambridge (2007-2017) and the Treasurer and Vice-President of the Royal Society (2012-2017). He obtained his D.Phil. at Oxford in 1972 and did post-doctoral work in the Materials Physics Division at Harwell. He joined the Chemistry faculty at Oxford in 1974, and then moved to UC Santa Barbara in 1991 to become Professor in the Materials Department. From 1992-2004 he was the Director of UCSB's Materials Research Laboratory. In January 2020 he was knighted by the Queen for "Services to Materials Chemistry, UK Science and Global Outreach".