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Chiral 2D hybrid perovskites with amino acid cations

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Layered 2D hybrid organic-inorganic perovskites (2D-HOIPs) exhibit a distinctive array of properties, including remarkable structural flexibility, enhanced resistance to moisture, and optoelectronic characteristics valuable for practical applications. Chiral HOIPs can widen the scope of possible applications towards detection and generation of circularly polarized light. We developed a series of new lead and tin-based 2D hybrid perovskites with cations of chiral α-amino acids: L-alanine,1 L-proline2 and L-histidine3. All obtained perovskites create layered structures in which inorganic layers are formed with MHal6 (M = Pb or Sn) octahedra connected in corner- of edge-sharing manner and are interleaved by organic layers established by amino acid cations. Chiral cations provide a breaking of spatial parity of these perovskites that results in their non-centrosymmetric crystal structures. The obtained chiral perovskites are semiconductors and display pronounced photoluminescence. Obtained (L-histidinium)2SnI4 has a remarkably low for 2D perovskites bandgap of 1.82 eV. As a "proof-of- concept", we created a prototype HOIPs photodetector. For the obtained prototype, light detection is observed in the wide range covering UV, visible and near-IR regions, marking a record achievement for 2D-HOIPs. Beyond photodetectors, these new perovskites hold promise for applications in various other optoelectronic devices, including solar cells, photodiodes, phototransistors, polarized light detectors, and more.

1 V. Y. Sirenko et al. New J. Chem., 2021, 45, 12606–12612.
2 V. Y. Sirenko et al. Dalt. Trans., 2023, 52, 10545–10556.
3 V. Y. Sirenko et al. Appl. Mater. Today, 2024, 41, 102452.

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Primary authors: Ms KUCHERIV, Olesia I. (Taras Shevchenko National University of Kyiv); Mr SIRENKO, Valerii Y. (Taras Shevchenko National University of Kyiv); Dr SHOVA, Sergiu ("Petru Poni"Institute of Macromolecular Chemistry); Dr GURAL'SKIY, Il'ya A. (Taras Shevchenko National University of Kyiv)

Presenter: Ms KUCHERIV, Olesia I. (Taras Shevchenko National University of Kyiv)

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