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Tuning physical properties by assembling subnanometer inorganic and organic units YONG ZHANG, P.A. PARILLA, S.P. AHRENKIEL, A. MASCARENHAS, NREL, Z. ISLAM, Y. REN, P.L. LEE, APS/ANL, M.J. MCNEVIN, UC. Boulder, I. NAUMOV, H.X. FU, U. Arkansas, X.Y. HUANG, J. LI, Rutgers U. — Designing inorganic-organic hybrid materials in a nanoscopic scale allows taking the full advantage of the two worlds, which has recently been demonstrated in a new family of hybrid crystalline materials that are the fully ordered assemblies of sub-nanometer scale inorganic units (e.g., few monolayer-thick slab, single atomic chain) and organic molecules[1].They have been shown to exhibit a number of unique properties that are not readily available in either of the components or their nanostructures: for instance, strongly enhanced exciton-polariton absorption and exciton binding energy[2], a massive bandgap blue shift ($\sim$ 2 eV) from that of the bulk inorganic semiconductor[3], and fine-tuning of thermal expansion and achieving zero-thermal expansio[4]. They have great potential for applications in areas including transparent conducting materials, thermoelectric materials, UV optoelectronic devices, because of their unusual electronic, vibrational and optical properties and the flexibility in tailoring the material properties adapting to the specific application requirements. .[1] X. H. Huang et al., JACS **125**, 7049 (03). [2] Y. Zhang et al., PRL **96**, 26405 (06). [3] B. Fluegel et al., PRB **70**, 205308 (04). [4] Y. Zhang et al., PRL **99**, 215901 (07).

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