Fascinating structure and physical properties of lead-free hybrid perovskites for multifunctional applications

S. K. Abdel-Aal[1,*], A. S. Abdel-Rahman[1], G. Bortel[2], Á. Pekker[2], K. Kamaras[2], G. Faigel[2]

[1]*Physics department, Faculty of Science, Cairo University, 12613, Giza Egypt*
[2] *Wigner Research Centre for Physics, Hungarian Academy of Sciences*

[*] *seham@sci.cu.edu.eg*

Hybrid perovskites of the formula A_2MX_4, A: ammonium substituted organic cation, M: a divalent metal ion and X: a halogen (Cl, Br, I) have attracted considerable attention recently. Their applications include lead-free perovskite solar cell [1], optoelectronic, exitonic and self-assembly quantum well. The properties of these hybrid perovskites OIHs are functions of A, M and X and there are possibilities to tailor the structure, physical and chemical properties according to the application needed [2-3]. The Co hybrid perovskite is a promising material for lead-free perovskite solar cell applications. Mn organic-inorganic hybrid can be used as catalysis and ultraviolet absorbing materials. Cu hybrid can be used in the application of self-assembly quantum well as well as lead-free perovskite solar cell [4]. Some of these materials posses reversible phase transition that may find application as sensors and data storage devises. The presenter has deposited about 15 of these novel hybrid perovskite materials at Cambridge Crystallographic Data Center (CCDC). For further investigation and characterization of diammonium hybrid perovskite materials xrf/xafs has been performed.

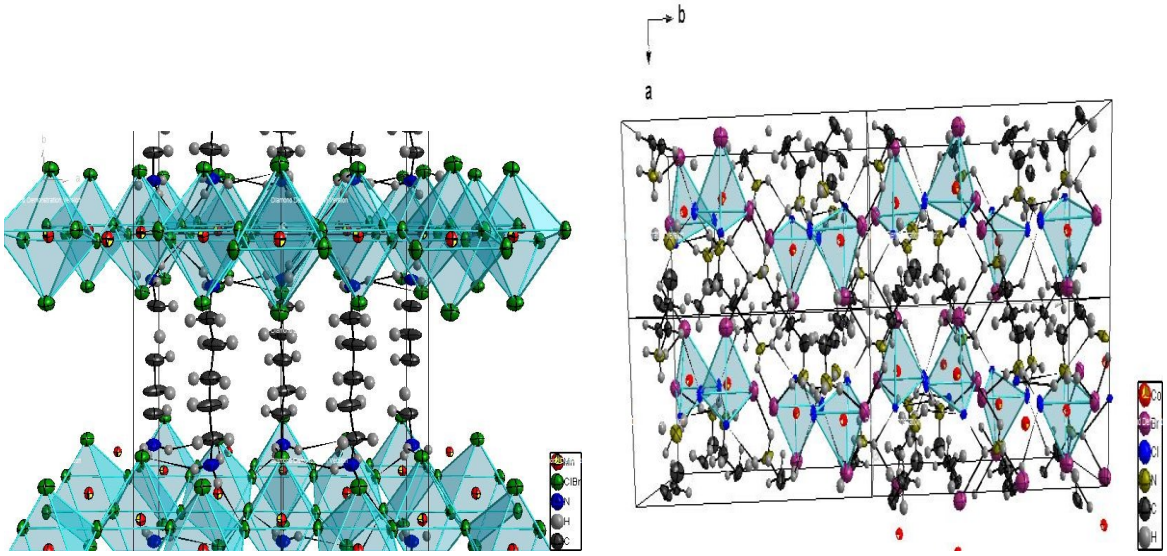

Figure 1. Left panel crystal structure of $[NH_3(CH_2)_5NH_3]MnCl_2Br_2$ at 240 K and right panel layered structure of $[NH_3(CH_2)_5NH_3]CoCl_2Br_2$ at T = 300 K.

[1] Abdel-Aal, S. K., Abdel-Rahman, A. S., Kocher-Oberlehner, G., Ionov, A. & Mozhchil, R. N. (2017). Acta Cryst. A73, C1116.

[2] Abdel-Aal, S. K., Abdel-Rahman, A. S., Gamal, W. M., Abdel-Kader, M., Ayoub, H. S., El-Sherif, A. F., Kandeel, M. F., Bozhko, S., Yakimov, E. E. & Yakimov, E. K. (2019). Acta Cryst. B75, 880-886.

[3] Abdel-Aal, S. K. & Abdel-Rahman, A. S. (2017) J. Cryst. Growth. 457, 282-288.

[4] Abdel-Aal, S. K. & Abdel-Rahman, A. S. (2019) J. Elec. Mat. 48(3) 1686-1693

Keywords: hyprid perovskite; photovoltaic applications; crystal structure

We acknowledge LAAAMP-FA-ST 2019 grant, ASRT project id 2311 and ASRT project id 3233