Effect of Solvents and Relative Humidity on $(C_6H_5(CH_2)_2NH_3)_2(Mn,Cu)Cl_4$ thin films

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Layered two-dimensional organic-inorganic perovskite thin films (A_2BX_4, A= a monovalent organic cation, B=a divalent metallic cation, X=a halide anion) have been proposed for a variety of industrial applications such as semiconducting channel in thin film transistors ($(C_6H_5C_2H_4NH_3)_2SnI_4$) [1] and multiferroics($(C_6H_5C_2H_4NH_3)_2CuCl_4$) [2] and optoelectronics devices($(C_4H_9NH_3)_2PbBr_4$) [3]. Particularly, $(C_6H_5(CH_2)_2NH_3)_2CuCl_4$ (shortly, Cu-PEA) and $(C_6H_5(CH_2)_2NH_3)_2MnCl_4$ (shortly, Mn-PEA) belong to a family of layered two-dimensional K_2NiF_4 perovskites where the inorganic part comprises a two dimensional network of corner-sharing BCl_6^{2-} octahedron. The interesting point is that they crystallize in the same space group (No. 61 P 2_1/b 2_1/c 2_1/a) at room temperature and show the almost same lattice parameters (a =7.187 Å, b= 7.344 Å, c=38.549 Å for Cu-PEA, a =7.207 Å, b =7.301 Å, c=39.413 Å for Mn-PEA), but different magnetic behaviors. Cu-PEA is a ferromagnet (T_C =9.5 ~13 K) [2], while Mn-PEA is a canted antiferromagnet (T_N = 44 K) [4]. It has been reported that organic-inorganic layered perovskite thin films can be readily prepared by a number of simple and versatile techniques such as sol-gel and spin-coating and Langmuir-Blodgett and evaporation. Even though the perovskite layers in all the previous cases were ultrathin (few to tens of nanometers), unencapsulated, and exposed to the air, structure stability of layered perovskite thin film against moisture has been rarely addressed so far. In this talk, the influence of organic solvents and relative humidity on structural and magnetic properties of unencapsulated Cu-PEA and Mn-PEA perovskite thin films synthesized by spin coating technique will be presented.

References

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