Nanostructured surfaces

Processing of thin films of organic-inorganic perovskites $CH_3NH_3PbI_3$ with control of microstructure

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In recent years, organic–inorganic metal halide perovskites $APbX_3$ ($A=CH_3NH_3$, X=Cl, Br, I) have been one of the most intensively investigated optoelectronic materials by researchers in many different disciplines [1]. Solar cell based on organic-inorganic perovskite evinces 20% solar conversion efficiency, what are approaching commercial monocrystalline silicon solar cells and has relatively low production costs [2].

In this work, the effect of starting reagents (CH_3NH_3I:PbI_2) with different ratios in raw solutions on the microstructure, phase composition, absorption, and luminescence spectra of the films of organic-inorganic perovskites $CH_3NH_3PbI_3$ has been investigated.

Organic-inorganic metal halide perovskite films by one-step deposition have been obtained. Starting reagents (PbI_2 and CH_3NH_3I) in different ratios were dissolved in DMF, and stirred until optically clear solutions are formed. The resulting solutions were spin-coated on the glass substrates. It has been found that the microstructure of films strongly depends on the ratio of starting reagents. With the stoichiometric ratio of the starting reagents, the films are formed by needle-like particles and with an increase in the content of CH_3NH_3I, a transition to the particles of a rounded and, subsequently, faceted shape is observed. At the same time, the fluorescence intensity of films increases and the absorption in the optical range becomes more selective.

1. *Brenner T. M., Egger D. A., Kronik L., Hodes G., Cahen D.* Hybrid organic-inorganic perovskites: low-cost semiconductors with intriguing charge-transport properties // Nature Reviews Materials.-2016.-**1**. Article: 15007.
2. *Cahen D., Lubomirsky I.* Self-Repairing Energy Materials: Sine Qua Non for a Sustainable Future // Acc. Chem. Res.-2017.-50. P 573-576.