



ABSTRACT BOOK

**International research
and practice conference:**

**NANOTECHNOLOGY
AND NANOMATERIALS
(NANO-2019)**

**27-30 August 2019
Lviv, Ukraine**

Synthesis and degradation of organic-inorganic compounds

Torchyniuk P.V.¹, V'yunov O.I.¹, Yukhymchuk V.O.²,
Hreshchuk O.M.², Belous A.G.¹

¹ Solid State Chemistry Department, V.I. Vernadsky Institute of General and Inorganic Chemistry, NAS of Ukraine, Palladina ave., 32/34, Kyiv-03142, Ukraine.

Corresponding author e-mail: pasha.torchyniuk@gmail.com

² V. E. Lashkaryov Institute of Semiconductor Physics, NAS of Ukraine, Prospect Nauky, 45, Kyiv-03028, Ukraine.

Organic-inorganic halide perovskites are important for the development of elements for solar energy conversion. These materials are characterized by high productivity and low cost of manufacturing, their power conversion energy exceeds 22% [1]. Solar cells based on them would take leading positions in photovoltaic technologies due to increasing their stability over time. Humidity, temperature, oxygen and ultraviolet radiation cause degradation of perovskite materials [2].

The aim of this work was to synthesize and study the influence of humidity, radiation and time of exposure on the degradation of organic-inorganic perovskite films $\text{CH}_3\text{NH}_3\text{PbI}_3$.

Solutions with different ratios of the initial reagents, PbI_2 and $\text{CH}_3\text{NH}_3\text{I}$ (1:1, 1:2, 1:3) in DMF were used for the synthesis of organic-inorganic compounds. The degradation of organic-inorganic perovskite films $\text{CH}_3\text{NH}_3\text{PbI}_3$ was estimated using a complex of methods: XRD, Raman spectroscopy, etc. Films degradation was evaluated by the change in the content of the additional phase PbI_2 with time from synthesis to 55 days. The film with the highest ratio of $\text{PbI}_2:\text{CH}_3\text{NH}_3\text{I}=1:3$ decomposes the least, the film with an intermediate ratio of $\text{PbI}_2:\text{CH}_3\text{NH}_3\text{I}=1:2$ is degraded most. This is also confirmed by the results of Raman spectroscopy. It has been shown that degradation of perovskite film results in transformation of the initial spectrum corresponding to the vibrational modes of $\text{CH}_3\text{NH}_3\text{PbI}_3$ into a spectrum of PbI_2 . It was established that the degradation of perovskite film (which was estimated at radiation with a wavelength of 532 nm) was accelerated with increasing power density and radiation time.

The authors would like to thank the Ukrainian National Academy of Sciences for providing the research grant (34/19-H) to support this work.

1. Correa-Baena J. P., Abate A., Saliba M., Tress W., Jacobsson T. J., Grätzel M., & Hagfeldt A. (2017). The rapid evolution of highly efficient perovskite solar cells. *Energy & Environmental Science*, 10(3), 710-727.

2. Domanski K., Alharbi E. A., Hagfeldt A., Grätzel M., & Tress W. (2018). Systematic investigation of the impact of operation conditions on the degradation behaviour of perovskite solar cells. *Nature Energy*, 3(1), 61.

Наукове видання

**The International research and practice conference
"Nanotechnology and nanomaterials"
(NANO-2019)**

**Book of abstracts is published in authors' edition without
modifying by the Organizing Committee**

Head of Organizing Committee:

Dr. *Olena Fesenko*, Institute of Physics of the NAS of Ukraine Design and layout:
Volodymyr Havlo

Technical support in the course of the International conference (NANO-2019). Junior Researchers of the Institute of Physics of the NAS of Ukraine A.D. Yaremkevych (media assistance) and Y.S. Kifiuk (sound equipment and photo report), Leading Engineers of the Institute of Physics of the NAS of Ukraine N.V. Skichko (informational and transportation support), O.P. Budnyk (registration of participants and excursions), Ye.V. Slobodanyk (registration of participants and general questions), T.V. Tsebrienko (registration support).

Здано в набір 24.07.2019. Підписано до друку 05.08.2019.
Формат 60х90/16. Папір офсетний. Умовн. друк. арк. 46,5. Зам. № 348.