



Mendeleev 2024

XIII International Conference on Chemistry
for Young Scientists

BOOK OF ABSTRACTS



St Petersburg
University

BOOK OF ABSTRACTS

**XIII International Conference on Chemistry
for Young Scientists “MENDELEEV 2024”**

St Petersburg, Russia
September 2-6,
2024

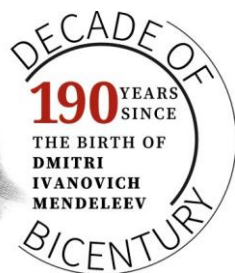
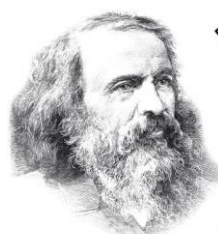
XIII International Conference on Chemistry for Young Scientists “MENDELEEV 2024”.
St Petersburg. September 2–6, 2024. Book of abstracts.— St Petersburg.: VVM
Publishing LLC, 2024.— 822 p.

ISBN 978-5-9651-1584-6

Book of abstracts contains theses of plenary, keynote, oral and poster presentations
which were presented on **Mendeleev 2024**, the XIII International Conference on
Chemistry for Young Scientists. The Mendeleev 2024 Conference hold in Saint
Petersburg (September 2–6, 2024).

Abstracts are presented in the author's edition with minimal technical corrections.

DEDICATED TO



@mendeleev.spbu



@Mendeleev_spbu

© Authors, 2024
© VVM Publishing LLC, 2024

INVESTIGATION OF PHOTODEPOSITED PLATINUM LOCALIZATION AT THE LAYERED OXIDES $\text{HCa}_2\text{Nb}_3\text{O}_{10}$, $\text{H}_2\text{La}_2\text{Ti}_3\text{O}_{10}$ AND THEIR ORGANO-INORGANIC HYBRIDS

Davydov N.A.¹, Gubanova A.N.¹, Silyukov O.I.¹, Rodionov I.A

¹ St. Petersburg State University, St. Petersburg, Russia
nikita.davidov02@yandex.ru

In recent years, environmental problems caused by using fossil fuel have become particularly acute. Hydrogen produced by the photocatalytic splitting of water and organic substrates under the action of sunlight can be a promising replacement for hydrocarbon fuel. Of particular interest among heterogeneous photocatalysts is a class of layered perovskite-like oxides, in the structure of which there is an alternation of negatively charged perovskite blocks with blocks of a different structure, called interlayer space, which can act as a separate reaction zone in the photocatalytic process [1]. The introduction of organic molecules, for example amines, into interlayer space contributes to an increase in the photocatalytic activity of samples in the reaction of obtaining hydrogen from a 1% (mol.) aqueous solution of methanol under the action of ultraviolet irradiation [2]. In this case, samples additionally modified with photo-deposited platinum particles exhibit particularly high activity. It was assumed that this effect is caused by the expansion of the interlayer space, which led to an increase in the accessibility of this zone for water and methanol molecules. The organic components undergo various transformations due to irradiation with ultraviolet light [3]. At the same time the activity of the photocatalyst remains constant throughout the experiment. A possible reason for the immutability of the activity of organo-inorganic hybrids may also be the deposition of platinum particles in the interlayer space expanded by the introduction of organic matter. In this instance, the activity of the samples would be preserved even after the decomposition of the organic modifiers.

This work focuses on the study of the effect of organic modifiers on the process of photo-deposition of platinum particles and the relationship of this process with the observed photocatalytic activity of hybrid samples of the layered oxides $\text{HCa}_2\text{Nb}_3\text{O}_{10}$ and $\text{H}_2\text{La}_2\text{Ti}_3\text{O}_{10}$. It was found that the sequence of procedures for modifying layered oxide $\text{H}_2\text{La}_2\text{Ti}_3\text{O}_{10}$ by intercalation of alkylamines RNH_2 ($\text{R} = \text{Me}, \text{Oc}$) and platination significantly affects the stability of the formed platinum particles to the action of aqua regia. The photocatalytic activity of organic platinized derivatives in the reaction of hydrogen extraction from a 1% (mol.) aqueous methanol solution under UV irradiation was also compared. It was shown that all modified samples exceed the initial $\text{H}_2\text{La}_2\text{Ti}_3\text{O}_{10}/\text{Pt}$ in terms of photocatalytic activity by 3 times or more, but they did not differ so markedly from each other. As the result it was found that intercalation of organic molecules can affect the deposition of platinum particles in layered oxide. At the same time, the stable photocatalytic activity of the samples is not due to the different spatial distribution of Pt nanoparticles. Thus, the increased activity of photocatalysts is rather associated with the modification of oxides by organic molecules.

References

- [1] *Russian Chem. Reviews* **2016**, 85, 3, 248-279
- [2] *Catalysts* **2022**, 12, 1556
- [3] *J. Phys. Chem.* **1991**, 95, 1345-1348

Acknowledgements

The work was supported by Russian Science Foundation (grant №22-73-10110). Authors are also grateful to Saint Petersburg State University Research Park: Centre for X-ray Diffraction Studies, Centre for Optical and Laser Materials Research, Centre for Chemical Analysis and Materials Research, Centre for Thermal Analysis and Calorimetry, Centre for Nanotechnology, Centre for Innovative Technologies of Composite Nanomaterials, Centre for Diagnostics of Functional Materials for Medicine, Pharmacology and Nanoelectronics.

