

SYNTHESIS AND STUDY OF CATALYTICALLY ACTIVE SOL-GEL-DERIVED $\text{SiO}_2@Pt/Pd$ COMPOSITES

Gubanova N.N.,^{a,b} Matveev V.A.,^a Shilova O.A.^{b,c},
Ivanova A.G.,^b Frank-Kamenetskaya O.V.^d

^a*Petersburg Nuclear Physics Institute of National Research Centre “Kurchatov Institute”,
Orlova rocsha 1, Gatchina, 188300, Russia,
e-mail: gubanova_nn@pnpi.nrcki.ru*

^b*Institute of Silicate Chemistry of the Russian Academy of Sciences, Saint-Petersburg, 199034, Russia*

^c*Saint Petersburg Electrotechnical University “LETI”, Saint-Petersburg, 197376, Russia*

^d*Saint Petersburg State University, Saint-Petersburg, 199034, Russia*

One of the promising ways of research is the synthesis of catalysts of metal nanoparticles of mixed composition, which include various noble metals, particularly Pt/Pd bimetallic nanoparticles. Different methods of synthesis allow one to acquire nanoparticles of different structures: “core-shell”, alloy with intermetallic compound or cluster-in-cluster, mixture of individual crystallites¹. The sol-gel synthesis is one of many methods used to generation of Pt/Pd bimetallic nanoparticles². This method used to acquire platinum and palladium catalysts for gas sensors and electrochemical devices.

In this work presents the results of a study of the structure of xerogels and thin films prepared from silica sols containing platinum and palladium compounds by X-ray diffraction (XRD) and transmission electron microscopy (TEM). It was determined that nanoparticles consist of the crystallites with a common bimetallic Pt/Pd lattice. The size of crystallites formed in xerogels is 10-18 nm and of the ones formed in films is 5-6 nm. The possibility of the formation of colloidal crystals and mesocrystals is discussed.

Optimal ratios of platinum and palladium in $\text{SiO}_2@Pt/Pd@C$ sol-gel-derived composites, which providing maximum catalytic activity as catalyst layers in hydrogen-air solid-polymer fuel cells were found.

References

1. G. Sharma, A. Kumar, S. Sharma, M. Naushad, R. Prakash Dwivedi, Z.A. Allothman, G.T. Mola, Novel development of nanoparticles to bimetallic nanoparticles and their composites: a review. *J. King Saud Univ. Sci.* (2017). <https://doi.org/10.1016/j.jksus.2017.06.012>.
2. Gubanova N.N., Matveev V.A., Shilova O.A., *J. of Sol-Gel Science and Technology*, 2019, <https://doi.org/10.1007/s10971-019-04971-y>.