

# Oleg Usoltsev

PhD in physics

Enthusiastic and perspective researcher with wide skills in materials characterization: EXAFS fitting, XANES simulation, XRD analysis, PCA, ML, DFT modeling; experienced in synchrotron experiments, primarily focused on the study of noble metal nanocatalysts.



✉ usoltsev.o.a@gmail.com

☎ +79286025445

📍 Rostov-on-Don, Sladkova st, 178/24, Rostov-on-Don, Russia

## WORK EXPERIENCE

### Engineer

The Smart Materials Research Institute

2016 - 2021

### Senior Researcher

The Smart Materials Research Institute

2022 - Present

Supervision

- 1 bachelor student of Physics Department
- 2 students of Specialized educational and scientific center

## EDUCATION

### PhD in Physics

The Smart Materials Research Institute,  
Southern Federal University, Russia

2018 - 2021

Theme

- Determination of the palladium nanoparticles atomic structure parameters by X-ray absorption spectroscopy

### Master degree in Physics

Southern Federal University, Russia

2016 - 2018

### Bachelor degree in Theoretical and Computational Physics

Southern Federal University, Russia

2012 - 2016

## CONFERENCES AND INTERSHIPS

5th International Conference on Applied Surface Science, Spain (2022)

XAFS conference, Australia (2021)

XXV General Assembly and Congress of the International Union of Crystallography (Czech Republic) (2021)

HERCULES, France (2020)

Haldor Topsoe scholarship program, Denmark (2019)

MCR-XI conference, Russia (2019)

Best poster prize

ERASMUS+ exchange program, Portugal (2019)

G-RISC program participant, Germany (2019)

Internship in DESY

Synchrotron based techniques and hands on course on in situ / operando XAFS, Germany (2019)

## SYNCHROTRON EXPERIMENTS

SuperXAS, SLS, Switzerland (04/2022)

- Turning DRIFTS spectroscopy into a quantitative tool for structural characterization of metal nanocatalysts

BM23, ESRF, France (04/2022)

- The role of functional groups on the absorption properties of metal-organic frameworks for wastewater remediation

STM, KISI-Kurchatov, Russia (02/2022)

- In situ study of noble metal nanoparticles during catalytic reactions

BM23, ESRF, France (09/2021)

- Operando spectroscopy meets artificial intelligence: online structural analysis of active sites under industrially relevant harsh conditions

CLAESS, ALBA, Spain (06/2021)

- Size-dependent formation and decomposition of surface and bulk palladium oxides in co-presence of oxidizing and reducing agents

BM31, ESRF, France (04/2021)

- Size-dependent formation and decomposition of surface and bulk palladium oxides in co-presence of oxidizing and reducing agents

BM23, ESRF, France (02/2021)

- Operando spectroscopy meets artificial intelligence: online structural analysis of active sites under industrially relevant harsh conditions

STM, KISI-Kurchatov, Russia (01/2021)

- Study of Pd nanocatalyst in industrial relevant reactions

ID24, ESRF, France (10/2018)

- Time-resolved operando XAS investigation of Pd-based nanocatalysts during oxidation of methane

BM23, ESRF, France (06/2018)

- Surface-Core-Shell Structure of Palladium Carbide Phase by In Situ XANES, EXAFS and XRPD

P64, PETRA-III, Germany (05/2018)

- Quick EXAFS study of palladium oxides

BM31, ESRF, France (05/2018)

- Core-shell structure of palladium carbide nanoparticles revealed by in situ EXAFS and XRPD

BM31, ESRF, France (12/2017)

- Core-shell structure of palladium carbide nanoparticles revealed by in situ EXAFS and XRPD

## SKILLS

Larch

Demeter

Python Programming

Data analysis

PCA

ML

DFT calculations

In situ experiments

Sample preparation

Scopus

ORCID

## Selected publications in peer-reviewed journals

Stuyck W., Bugaev A.L., Nelis T., de Oliveira-Silva R., Smolders S., Usoltsev O.A., Arenas E.D., Bals S., Sakellariou D., De Vos D.

### **Sustainable formation of tricarballylic acid from citric acid over highly stable Pd/Nb<sub>2</sub>O<sub>5</sub>·nH<sub>2</sub>O catalysts**

*Journal of Catalysis*, 408, pp. 88 (2022)

<https://doi.org/10.1016/j.jcat.2022.02.013>

Usoltsev O.A., Bugaev A.L., Guda A.A., Guda S.A., Soldatov A.

### **How Much Structural Information Could Be Extracted from XANES Spectra for Palladium Hydride and Carbide Nanoparticles**

*Journal of Physical Chemistry C*, 126 (10), pp. 4921 (2022)

<https://pubs.acs.org/doi/10.1021/acs.jpcc.1c09420>

Bugaev A.L., Usoltsev O.A., Guda A.A., Lomachenko K.A., Brunelli M., Groppo E., Pellegrini R., Soldatov A.V., Van Bokhoven J.A.

### **Hydrogenation of ethylene over palladium: Evolution of the catalyst structure by operando synchrotron-based techniques**

*Faraday Discussions*, 229, pp. 197 (2021)

<https://doi.org/10.1039/C9FD00139E>

Zhang W., He P., Wang Ch., Ding T., Chen T., Liu X., Cao L., Huang T., Shen X., Usoltsev O.A., Bugaev A.L., Lin Yu.

### **Operando evidence of Cu<sup>+</sup> stabilization via a single-atom modifier for CO<sub>2</sub> electroreduction**

*Journal of Materials Chemistry A*, 8 (48), pp. 25970 (2020)

<https://doi.org/10.1039/D0TA08369K>

Bugaev A.L., Zabilskiy M., Skorynina A.A., Usoltsev O.A., Soldatov A.V., Van Bokhoven J.A.

### **In situ formation of surface and bulk oxides in small palladium nanoparticles**

*Chemical Communications*, 56 (86), pp. 13097 (2020)

<https://doi.org/10.1039/D0CC05050D>

Skorynina A.A., Tereshchenko A.A., Usoltsev O.A., Bugaev A.L., Lomachenko K.A., Guda A.A., Groppo E., Pellegrini R., Lamberti C., Soldatov A.V.

### **Time-dependent carbide phase formation in palladium nanoparticles**

*Radiation Physics and Chemistry*, 175, pp 108079 (2020)

<https://doi.org/10.1016/j.radphyschem.2018.11.033>

Usoltsev O.A., Pnevskaya A.Yu., Kamyshova E.G., Tereshchenko A.A., Skorynina A.A., Zhang W., Yao T., Bugaev A.L., Soldatov A.V.

### **Dehydrogenation of ethylene on supported palladium nanoparticles: A double view from metal and hydrocarbon sides**

*Nanomaterials*, 10 (9), pp. 1 (2020)

<https://doi.org/10.3390/nano10091643>

Martini A., Guda S.A., Guda A.A., Smolentsev G., Algasov A., Usoltsev O., Soldatov M.A., Bugaev A.L., Rusalev Yu., Lamberti C., Soldatov A.V.

### **PyFitit: The software for quantitative analysis of XANES spectra using machine-learning algorithms**

*Computer Physics Communications*, 250, pp. 107064 (2020)

<https://doi.org/10.1016/j.cpc.2019.107064>

Usoltsev O.A., Bugaev A.L., Guda A.A., Guda S.A., Soldatov, A.V.

### **Absorption of Hydrocarbons on Palladium Catalysts: From Simple Models Towards Machine Learning Analysis of X-ray Absorption Spectroscopy Data**

*Topics in Catalysis*, 63 (1-2), pp.58 (2020)

<https://doi.org/10.1007/s11244-020-01221-2>

Bugaev A.L., Usoltsev O.A., Guda A.A., Lomachenko K.A., Pankin I.A., Rusalev Yu.V., Emerich H., Groppo E., Pellegrini R., Soldatov A.V., Van Bokhoven J.A., Lamberti C.

### **Palladium Carbide and Hydride Formation in the Bulk and at the Surface of Palladium Nanoparticles**

*Journal of Physical Chemistry C*, 122 (22), pp. 12029 (2020)

<https://doi.org/10.1021/acs.jpcc.7b11473>

Bugaev A.L., Usoltsev O.A., Lazzarini A., Lomachenko K.A., Guda A.A., Pellegrini R., Carosso M., Vitillo J.G., Groppo E., Van Bokhoven J.A., Soldatov A.V., Lamberti C.

### **Time-resolved operando studies of carbon supported Pd nanoparticles under hydrogenation reactions by X-ray diffraction and absorption**

*Faraday Discussions*, 208, pp. 187 (2018)

<https://doi.org/10.1039/c7fd00211d>