



Slovak Society of Chemical Engineering  
Institute of Chemical and Environmental Engineering  
Slovak University of Technology in Bratislava

## PROCEEDINGS

51<sup>st</sup> International Conference of the Slovak Society of Chemical Engineering SSCHE 2025

Hotel DRUŽBA  
Jasná, Demänovská Dolina, Slovakia  
May 27 - 30, 2025

Editors: Assoc. Prof. Mário Mihaľ

ISBN: 978-80-8208-158-2, EAN: 9788082081582

Published by the Faculty of Chemical and Food Technology Slovak Technical University in Bratislava in Slovak Chemistry Library for the Institute of Chemical and Environmental Engineering; Radlinského 9, 812 37 Bratislava, 2024

Balabánová, J., Topka, P., Šolcová, O., Soukup, K.: Preparation of nanofibrous catalysts for catalytic oxidation of volatile organic compounds by electrospinning, Editors: Mihaľ, M., In *51st International Conference of the Slovak Society of Chemical Engineering SSCHE 2025*, Jasná, Demänovská Dolina, Slovakia, 2025.

## **Preparation of nanofibrous catalysts for catalytic oxidation of volatile organic compounds by electrospinning**

J. Balabánová, P. Topka, O. Šolcová, K. Soukup

*Institute of Chemical Process Fundamentals of the CAS, v. v. i., Rozvojová 135, CZ-165 00  
Prague 6, Czech Republic*

*e-mail: balabanova@icpf.cas.cz*

**Keywords:** electrospun catalyst, polybenzimidazole, volatile organic compounds, catalytic oxidation.

One of the advanced methods for the preparation of heterogeneous catalysts is electrospinning, which offers unique possibilities in the production of catalytic supports. This technique enables the creation of materials with high surface area, controlled porosity, and tailored surface functionalities – all of which are key parameters for achieving high catalytic efficiency and selectivity. The nanofibrous structure of electrospun materials further enhances mass transfer and reaction kinetics, which is particularly critical for processes operating under high space velocities. Due to its versatility, electrospinning represents an effective tool for the preparation of innovative catalytic systems that can contribute to more efficient and sustainable environmental solutions in industrial applications.

Nanofibrous catalysts can be employed in the catalytic oxidation of volatile organic compounds (VOCs). This method is both effective and environmentally friendly, as it helps to reduce VOC emissions that contribute to air pollution. Suitable catalysts include materials impregnated with noble metals, such as platinum or palladium. Noble metal-based catalysts play a crucial role due to their high catalytic activity and stability.

This study presents a promising method for preparing efficient nanofibrous catalyst supports based on thermally and chemically resistant polybenzimidazole (PBI) via electrospinning. For model VOCs (ethanol, acetone, and toluene), the catalysts with low platinum content achieved high conversion rates (90%) at temperatures below 290 °C.

The results demonstrate the potential of these materials for applications in gas-phase reactions, such as VOC oxidation, with platinum nanoparticles serving as catalytically active sites. Unlike conventional pelletized catalysts, the high porosity of electrospun mats ensures easy accessibility of the platinum active sites to the reactants while maintaining a low-pressure drop in the catalytic bed.

### *Acknowledgement*

The authors gratefully acknowledge the financial support provided by the Technology Agency of the Czech Republic (National Center of Competence, project no. TN02000044 “Biorefining and circular economy for sustainability”).