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

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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.

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