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Microwave-Assisted Catalytic Polymer Cracking into Hydrogen at Low Temperatures Using Ionic Liquids and Nanoparticles

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Abstract

The conversion of polymers into valuable products, including, hydrogen (H_2) and carbon, at low temperatures represents a promising approach to achieving economic feasibility in industry. This EU-funded project examines a new catalytic concept designed to enhance the efficiency of polymer cracking, with the objective of producing a high-yield H_2 stream at temperatures below 300°C. Our approach is a novel catalytic concept that involves the dissolution of polymers in new high-temperature-stable ionic liquids (ILs), which should enhance the catalytic activity of the nanoparticle catalysts. The use of microwave radiation as an alternative heating method allows for rapid and uniform energy transfer to the system, which may result in lower reaction temperatures and reduced energy costs. It is anticipated that this catalytic system will yield high-purity hydrogen at lower temperatures than in conventional processes. Furthermore, the utilisation of ILs should facilitate easy catalyst recovery and reduce coking. This study proposes a novel catalytic concept that integrates the use of high-temperature-stable ILs and microwave-heated catalysts, potentially creating a more efficient and sustainable approach to polymer cracking. This approach could pave the way for the design of tailored ILs and the development of microwave-compatible catalysts that significantly enhance performance and cost-efficiency in clean hydrogen production.