Synthesis of heterogeneous catalysts with acidic properties using 3D printing

The main purpose of the research is the application of additive manufacturing technologies (3D printing) in the synthesis of heterogeneous monolithic catalysts with acidic properties – having the layer of zeolite ZSM-5 and studying their physicochemical and catalytic properties in the model α-pinene isomerization process. The additional purpose is the development of a method of terpenes isomerization in a gas phase using monolithic catalysts.

In this work polymeric templates (matrixes) for catalysts will be printed. On their base, ceramic monoliths will be prepared, which the layers of zeolite ZSM-5 will be deposited onto. The obtained monolithic catalysts will be tested for physicochemical and catalytic properties in the gas-phase α-pinene isomerization process.

The reason for undertaking the research topic is the need to develop a simple method for the synthesis of monolithic catalysts with both physicochemical and structural properties best suited to a specific process. This type of catalysts possesses a number of advantages over the conventional powder type and in some processes it could show better catalytic properties.

The choice of the synthesis of catalysts with acidic properties containing zeolite is due to the wide array of potential applications, and the choice of isomerization of α-pinene as a test process – the possibility of receiving the great variety of compounds for various industries from a renewable and inexpensive raw material. The proposed method of the synthesis of catalysts using 3D printers provides the precise control of architecture of matrixes, and thus catalysts, being their negative replicas. This will help to show that it is possible to control the gas-phase process easily in order to obtain specific products by the use of monolithic catalysts having different physicochemical and structural properties and differential process conditions.