Dealumination of Y zeolite through an economic and eco-friendly defect-engineering strategy

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Abstract

In this article, a sustainable defect-engineering strategy for dealumination of Y zeolite is described. This strategy includes the green synthesis of a well-crystallized Y zeolite with point defects arising from the incorporation of Fe atoms by using a Fe-containing perlite and the subsequent preparation of ultra-stable Y (USY) zeolite by effective dealumination. The systematic characterizations verify that Fe atoms originally existing in the perlite are incorporated into the as-synthesized Y zeolite and function as point defects, leading to the distortion of framework Al. The step-by-step investigation of the dealumination process shows that vacancies are formed by the extraction of framework Fe in the ammonium exchange, and the framework dealumination is promoted under the combined effect of the distorted framework Al and the formed vacancies during the steaming treatment. The resulting USY zeolite owns excellent features in (hydro)thermal stability, pore structure and acid property, and thus exhibits outstanding catalytic cracking performance.

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