

# Temperature-Programmed X-ray Diffraction Studies on Phase transitions of Modified ZMS-5 Catalysts for C4-olefin cracking reactions

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## Abstract

Temperature-programmed X-ray diffraction technology is employed to study phase transitions of modified ZSM-5 catalysts for C4-olefin cracking reactions to produce propylene. The crystal phase transitions of the fresh, used and regenerated catalysts are investigated respectively with temperature increasing and decreasing under vacuum and air conditions.

The samples were prepared with following steps. HZSM-5 zeolite and Al<sub>2</sub>O<sub>3</sub> (as binder) were fully mixed, kneaded and then molded by extruder. Elements of alkaline-earth metals and phosphorus were introduced by impregnation. After drying and calcination, the fresh ZSM-5-based catalyst was obtained. The catalyst for C4 cracking was evaluated in a fixed-bed reactor. The deactivated catalyst was regenerated through combustion with the mixture of air and nitrogen on line.

The crystal structures of the samples were recorded by X-ray powder diffraction analysis on Bruker AXS D8 Advance SSS X-ray diffractometer equipped with a graphite monochromator and scintillation counter, and using CuK $\alpha$  radiation (40KV and 300mA). Anton Parr XRK900 reaction chamber was equipped, which was used to heat samples from room temperature to 900°C and provide certain experimental conditions.

The research results show the crystal phases of all these catalyst are changed into orthorhombic structure when the temperature is increased to a certain degree no matter what kind of their initial crystal structure (monoclinic or orthorhombic)(shown in fig.1). The experimental conditions (vacuum and air) prove further the water has nothing with phase transitions of these catalysts.

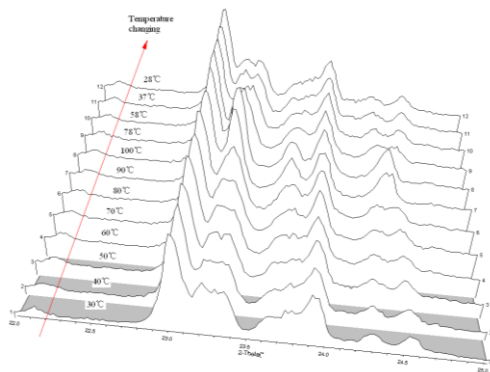


Fig.1 The XRD patterns of phase transition of the regenerated catalyst sample