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## Pd-impregnated Pt/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> Catalysts for Isomerization of Straight Light Naphtha

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Isomerization of light naphtha containing sulfur compounds was investigated over metal/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> catalysts, and the appearance of sulfur tolerance was discussed using the analysis of the metal distribution in the sulfur-tolerant isomerization catalysts. Although the isomerization activity of the conventional Pt/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> catalyst decreased linearly in the presence of sulfur in the feed, the Pd-impregnated Pt/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> catalyst, in which Pd was added to the Pt/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> carrier, maintained stable isomerization activity even in the presence of high concentrations of sulfur. EPMA (Electron Probe Micro Analysis) investigation of the metal distribution indicated that a hybrid structure (Pt/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Pd/Al<sub>2</sub>O<sub>3</sub>) was formed in the Pd-impregnated catalyst, and that the high sulfur tolerance of the catalyst originated in the desulfurization function of the Pd/Al<sub>2</sub>O<sub>3</sub> particles formed in the catalyst. To investigate the effect of the Pd/Al<sub>2</sub>O<sub>3</sub> particles, isomerization was carried out over a powder mixture of Pt/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> catalyst and Pd/Al<sub>2</sub>O<sub>3</sub> catalyst. Since the powder mixture catalyst also showed sulfur tolerance equal to the Pd-impregnated Pt/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> catalyst, it was suggested that the Pd/Al<sub>2</sub>O<sub>3</sub> particles supply hydrogen to the Pt/SO<sub>4</sub><sup>2-</sup>/ZrO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> particles in addition to catalyzing hydrodesulfurization. Moreover, the lifetime test showed

that the sulfur tolerance of Pd-impregnated  $\text{Pt}/\text{SO}_4^{2-}/\text{ZrO}_2\text{-Al}_2\text{O}_3$  catalyst was maintained in the long term, and that products with higher octane number could be obtained stably even from the isomerization of sulfur-containing light naphtha.

**Keywords:** [Sulfated zirconia alumina catalyst](#), [Platinum catalyst](#), [Palladium catalyst](#), [Light naphtha](#), [Skeletal isomerization](#), [Sulfur tolerance](#)

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