

Thermal, Hydrothermal and Catalytic Cracking of Bitumen Upgrading

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Abstract

Pyrolysis of bitumen has been performed without water, in supercritical water and over cerium oxide catalyst to further understanding the upgrading mechanism of bitumen at 723 K. The asphaltene conversion was promoted in catalytic cracking compare with hydrothermal and thermal cracking, respectively. Based on the results, the lightest oil was extracted in catalytic cracking and the concentration of asphaltene in rich oil phase was decreased. On the other hand, physical effect of water can change phase equilibrium which affects the reforming reactions. Another keen aspect is of hydrogen transfer from water to heavy oils in the presence of catalyst. In this research, CeO_2 was employed as catalyst and the possibility of oxidative decomposition and hydrogenation of bitumen in supercritical water was studied. A redox reaction between the water, bitumen, and catalyst was occurred for the production of hydrogen and oxygen. It was found that the oxygen storage capacity (OSC) of the cerium oxide nanoparticles with cubic {100} facets was nearly 3.4 times higher than that of the cerium oxide nanoparticles with octahedral {111} facets. Therefore, heavy oil fractions of bitumen were cracked in a batch-type reactor at 723 K in order to produce as much light oil as possible, and the effect of water density, the catalyst loading and reaction conditions on the conversion rate and coke formation were investigated. As a result, it was demonstrated that it is possible to obtain a high conversion rate by employing cubic CeO_2 nanocatalyst that shows high exposed surface area and large OSC.

Keywords: Bitumen, Nanocatalyst, Upgrading, Supercritical water, Oxygen storage capacity

Biography:

Mehdi Dejhosseini has completed his PhD from Tohoku university in Sep 2013 and continued as postdoctoral fellow for 2years in department of chemical engineering inTohoku university in Japan. He is researcher, energy and oil expert in National Iranian Oil Refining and Distribution Company. He has published more than 5 papers in reputed journals.