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Preface

Hydroprocessing of heavy oil fractions

Petroleum refining industry has entered a significant transition period and important changes have occurred over the past few years. Nowadays, refineries need to improve the processing of heavy feedstocks into valuable and environment-friendly products. Refinery operations have to evolve and include next-generation processes and catalysts to fulfill the demand for high-quality transportation fuels.

It is not a secret that worldwide crude oils available to refineries are becoming heavier. At the same time, the demand for lighter products and middle distillates has grown steadly due to the demand of transportation fuels. Since the quality of these products has to be improved to satisfy stringent environmental regulations, refineries, which have been traditionally processing light crude oils, face drastic changes in petroleum feed properties (such as increases in asphaltenes, sulfur, metals, and nitrogen contents) due to the growing volume of heavy crudes. These trends put great challenges to refining industry to process heavier crude oils.

In Mexico, mainly three grades of crude oil are available: heavy Maya, light low-sulfur Isthmus, and extra-light Olmeca. Maya accounts for more than half of total production. To solve the problematic associated with heavy crude oils, Pemex, The Mexican Oil Company, has announced overall refinery reconfiguration projects. The projects are expected to result in increased production, enhanced product quality, additional product slates for the refineries, and of course, better processing of heavy crudes.

When processing heavy feedstocks, lot of problems are faced because of the presence of high levels of impurities in the feeds, such as:

- High levels of metals cause permanent deactivation of the catalysts used in FCC, RCC and HCR.
- High nitrogen content, especially basic nitrogen, results in the temporary deactivation of acid catalysts, such as those used in FCC process.
- Higher coke deposition and poor yield of liquid products in FCC, RCC and HCR are the results of higher conradson carbon residue (CCR) and asphaltene contents of the crudes.
- Products also contain high levels of sulfur because of the presence of high sulfur in the feedstocks.

Hence, to convert heavy oils into suitable feedstocks for secondary conversion processes, these impurities need to be removed. A variety of conversion processes is available in the market to convert heavy oils into high-value products, which are different from one another in terms of the method and products slates. Among all commercially applied options, catalytic hydroprocessing, either as pretreatment (primary conversion step) or as upgrading, remains being one of the most promising technologies for conversion of heavy oils.

The major goal of hydroprocessing is the hydrocracking of heavy fractions with simultaneous hydrodesulfurization, hydrodenitrogenation, hydrodemetallization, and asphaltene conversion. This process brings down the level of the impurities present in the feed providing additional quantity of better quality feedstocks for FCC, RCC and HCR processes. As comparison with hydroconversion of light distillates, hydroprocessing of heavy oils is difficult because of the complex nature of the heteroatom bearing molecules. During hydroprocessing, such heteroatoms escape out from the systems as gaseous products and the more refractory compounds remain in the liquid products, while metals get irreversibly deposited on the catalysts causing permanent deactivation.

Hydroprocessing technology is well established and has been extensively practiced in worldwide refineries. However, most of the available information on this process has been obtained with light distillates, which to some degree can be applicable to hydroprocessing of heavy oils. Processing these heavy feeds presents various problems that are not found with light distillates processing.

Within this context this issue is devoted to discuss various topics relevant to hydroprocessing of heavy oils and its importance in the present scenario. Twenty-five papers are organized in different subjects, such as catalysis, kinetic modeling, asphaltenes characterization and conversion, and process aspects. Especial emphasis has been given in contributions experimenting with real feedstock and conditions, at bench and pilot plant scales, including catalyst deactivation and reasonable stabilization time.

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