Advanced Slurry Hydrocracking of Heavy Oil: New, Commercializable Catalysts

Alak Bhattacharyya,* *Beckay Mezza, Maureen Bricker, and Lorenz Bauer*
Research and Development, UOP – A Honeywell company, 25 E. Algonquin Road, Des Plaines, IL 60017
Alak.bhattacharyya@uop.com

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Introduction

An increasing portion of the worlds oil reserves consist of heavy oil that produces low yields of useful products when processed with existing technologies. UOP is commercializing the UOP SRC Uniflex process for these feeds as part of an integrated flow scheme to produce improved yields of transportation fuels and chemical feedstocks. The main role of the catalyst in the process is to allow operation at high conversion with minimal yields of various solid hydrocarbons. The catalyst does this by activating hydrogen, which can cap free radicals formed in the process. Various catalysts have been used for this purpose including molybdenum. However, Mo may not be cost effective. Here we will describe the performance of several new catalysts including one of UOP's proprietary catalysts. This novel catalyst is more active, selective, and cost-effective than previous catalysts.

Materials and Methods

The pilot plants used in this study consist of 1-liter Parr stirred reactors equipped with a continuous H_2 feed system. X-ray diffraction powder patterns are used to study the crystallite size of the fresh and spent catalysts.

Results and Discussion

Several catalysts were evaluated including an effective catalyst used in a commercial Slurry Hydrocracking unit, $Fe(SO_4).H_2O$ (ISM). In the reactor, this material decomposes to form FeS, which is the active species of this catalyst in the process [1]. In the course of the screening studies with many new materials, a novel, more active, UOP proprietary catalyst was discovered (UOP-1, Figure 1). This novel catalyst was found to be superior to other catalysts in terms of activity, selectivity to desired liquids, and ability to reduce the formation of coke particles. Sulfur in the feed converts these oxide-based catalysts to the active form in the reactor. We will describe the catalyst screening study and active species formation characteristics to describe the superiority of the novel UOP catalyst [2].

Significance

UOP is commercializing the SRC Uniflex process with this advanced catalyst as part of an integrated flow scheme to produce improved yields of transportation fuels and chemical feedstocks.

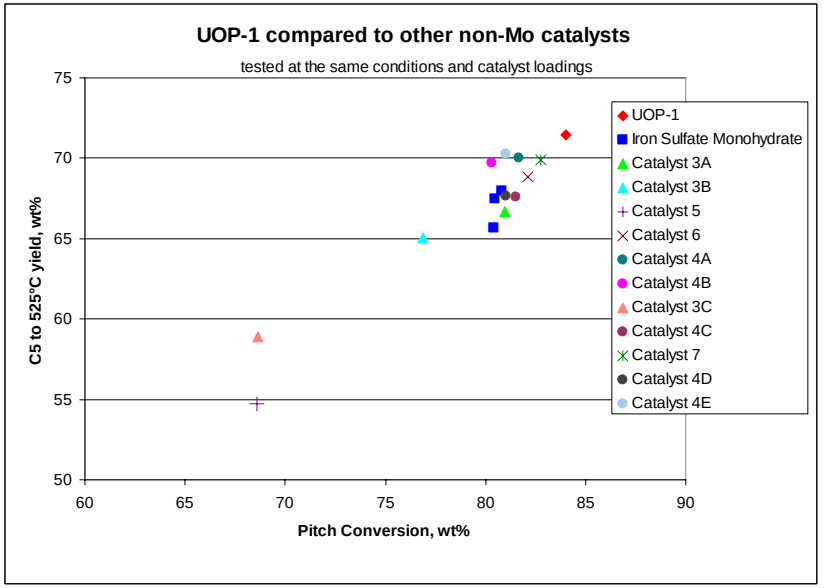

Figure 1. Pilot plant data comparing various catalysts to UOP proprietary catalyst (UOP- 1). Wt% Pitch conversion vs. C5 to 525°C product yield.

References

1. Belinko, K., Khulbe, C. P., Jain, A. K. *US Patent* 4,963,247, (1990).
2. UOP Patents Pending