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# A comparative activity study of a new ultra-dispersed catalyst system for a hydrocracking/hydrotreating technology using vacuum residue oil: Merey/Mesa

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ABSTRACT

Ultra-dispersed catalysts give an improvement over the main reactions activity by having a low deactivation rate. They provide as well other advantages like a diminution in the catalysts metal concentration, a reduction in contaminants and also these catalysts can be used in almost every area where heterogeneous catalysts are used. Catalysts synthesis optimization is important to improve process recovery, especially in hydrocracking/hydrotreating processes, where feedstock is vacuum residue. Here, we have evaluated the catalytic performance of two molybdenum–nickel catalysts prepared using different emulsion formulation, named E-T (base catalyst) and AT-48 (new catalyst). Our results showed that, the percentage of converted products for VR 500 °C$^+$, asphaltenes and microcarbon are comparable for both E-T and AT-48 catalysts, despite the fact that for the latter a lower molybdenum concentration was used. In addition, post-catalytic particles analyses using SEM and TEM techniques demonstrated that AT-48 catalyst showed a non-aggregated and homogeneous narrower distribution of metallic particles than E-T one. The lower average particle size distribution is related to the improvement of the liquid product yields for the hydroconversion of Mery/Mesa VR using the AT-48 catalyst.



*Keywords:* Ultra-dispersed catalyst; AHM; Hydrocracking; Hydrotreating; Hydroprocessing

## 1. Introduction

The use of ultra-dispersed catalysts becomes an ideal alternative to treat heavy feedstocks and petroleum residues because high dispersion of metallic species is obtained. Therefore, an elevated activity toward main reactions of interest (Panariti et al., 2000a,b; Marchionna et al., 1994), are reached because of a high ratio area/volume. It is known that heterogeneous catalysts also have a high activity, but in addition they have a high deactivation rate which reduces their use in processes that work with high quantities of contaminants.

Ultra-dispersed catalysts can be classified as: heterogeneous and homogeneous depending on their miscibility under reaction conditions. Homogeneous catalysts can be divided in soluble compounds in aqueous phase or in organic phase. Heterogeneous solids are introduced to the process through dry dispersion of the catalytic solid or precursor, finely divided into the crude (Ren et al., 2004; Thompson et al., 2008). Main disadvantage of heterogeneous solids is that they have a lower activity and generate by products of difficult handling.

In addition, soluble metallic precursors are highly reactive, but they have an elevated cost to be use at high scale. In the other hand, soluble compounds in aqueous phase are injected to process as catalytic emulsions, with the advantage that these precursors are cheaper in comparison with the organometallics.

Currently, new technologies aim to use ultra-dispersed catalysts, prepared from metallic precursors soluble in aqueous phase (Intevep, 2000). PDVSA Intevep has been developing technologies in order to obtain deep conversion for

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