

The Refinery of the Future: Challenges for developing new catalytic materials

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The dwindling supply and dramatic price increase of traditional source of hydrocarbons, the introduction of renewable feed stocks, the global concern in environmental protection and the demands for new products shape the concept of the refinery in the future. It should be flexible in raw material, capable of using even urban wastes; energetically efficient, minimizing unnecessary expenses; clean in its operations, with “near zero” emissions, including that of CO₂, to attenuate the green house effect; and, diversified in terms of products, which include not only fuels, but petrochemicals, chemicals and various forms of energy.

Historically, the catalytic processes played a fundamental role in the refining of petroleum. They have provided means to convert very heavy feeds as well as to obtain products of high aggregated values. No doubt, they will be responsible for the success of the refinery of the future.

The present work will start by describing the present and future scenarios of refining in Brazil with a strategic vision of Petrobras. Then, practical examples of the challenges and the technological solutions found from the developments of new catalysts will be presented. These include catalysts that process extra-heavy feeds and bio-mass, lift the yields for valuable light olefins, nano-materials for photo-catalysis, regeneration of catalysts in CO₂ rich atmosphere as well as production of low sulfur diesel fuel. Besides demonstrating the potential for new catalytic materials, these examples also indicated the need of innovative approaches. The experience of the company testified that new material can be developed efficiently and lead to real impact when one:

- has sound knowledge of how the material fundamentally works;
- takes into account of the multiple factors involved during its applications;
- is able to produce the material practically and economically in commercial scale.

Indeed, the fundamental and technical challenges for the development of new catalytic materials for the refinery of the future listed in this work are both large in number and complex in nature. To respond to such challenges, Petrobras is continuously and heavily investing in R&D in various related areas. Notably are the efforts in stimulating and supporting research in different institutions in Brazil, through the Research Networks. The development of new catalytic materials could be supported by different networks, such as that of: refining processes and products, catalysis, materials for refining and clean fuels. Through these links we look for both the creative solutions from individual groups and synergism between groups of different vocations with active involvement of the PETROBRAS R&D Center.

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