

Processing difficult crudes

Facing the challenge: developing new processing technologies



Oil companies talk increasingly about producing unconventional crude oils as part of their strategies for securing global energy supplies. These heavy and impure crude oils can be relatively cheap to buy, and so present an opportunity for those refineries that can make the conversion processes economic. The challenge is to develop the new processing technologies required.

“There have always been some crude oils that are more difficult to process than others,” says Carl Mesters, chief scientist, chemistry and catalysis, Shell Global Solutions International BV. “The issue is availability. The demand for products refined from easy-to-process crude oils is outstripping their supply, and this is reflected in the high prices of these crudes. There is greater availability of the difficult-to-process crudes, but the capacity to process them has not increased fast enough and refining them can be relatively expensive.”

Difficult crude is an informal term that broadly relates to the American Petroleum

Institute’s “unconventional oil” classification for oil with high densities (heavy oil, extra heavy oil, tar sands and bitumen). There are many properties that make such crude oils relatively difficult and expensive to refine into high-value products like gasoline.

The boiling point distribution (heaviness) of the hydrocarbons, the hydrogen and carbon contents, and the levels of impurities in crude oil are all important properties to be considered in relation to conversion. Removal of sulphur to meet environmental standards is well reported, but the presence of impurities such as nitrogen-containing species, salts, acids, metals and even solids can also make meeting product specifications demanding and expensive.

Mesters notes, “It is dealing with combinations of impurities and heaviness that can make processing a real challenge. Refineries have a limited number of conversion processes at their disposal. The less complex refineries in particular have limited conversion options and a restricted choice of crude oils.

“Unconventional oil is, at least for the Shell Group, a growth area that is going to help us to keep pace with the world’s energy demands. So, we are acting by holding and attending symposiums and meetings to stimulate new thinking on how we handle these difficult-to-process crude oils.”

However, heavy oil upgrading is an unfashionable academic subject outside Canada and China. Canada has an established tar sands industry, and the Canadian Heavy Oil Association provides a technical and educational forum. China hosted the 2006 World Heavy Oil Conference. Crude oil is a complex molecular system, but those US and European academics who study such systems tend to be interested in areas like genomics (the study of genes and their functions) or nanotechnology, for example.

In a 2006 speech to the Cambridge Energy Research Associates’ annual meeting of energy executives, Jeroen van der Veer, chief executive, Royal Dutch Shell plc, stressed the need to develop the potential of unconventional hydrocarbons. He noted that the technological advances required to enable lighter and cleaner products to be produced from heavier and more acidic crudes will be very important in refining.

Mesters concludes, “Our challenge is to develop new technologies and business models that make the processing of difficult crude oils economically viable. We have to investigate novel ways of upgrading those crude oils that are heavy and that contain many impurities and also have to continue our efforts to provide cleaner products.”

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