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Novel methods for upgrading heavy petroleum products

Russell R Chianelli University of Texas at El Paso, USA

In this report, two methods that were developed for upgrading heavy petroleum products will be discussed. The first method is called "*Catalytic Coking*". This method relies on the principle of *Catalytic Micro-Reversibility* which states that at high H_2 pressure a catalyst such as MoS_2 will add hydrogen to molecules, for example aromatic saturation. But at low H_2 pressure the catalyst will extract hydrogen from various molecules and create more coke. In a recent study with Canadian Tar Sands the "*Catalytic Coking*" technology with very favorable results was applied. The tests covered a range of process temperatures and catalyst concentrations in order to explore the broad effects of catalyst performance. Typical reactor process conditions were 400 – 450°C for periods of up to one hour, with catalyst weight concentrations ranging from approximately 0.2% to just under 1.0%. All tests were conducted at ambient pressure in a hydrogen atmosphere. Results show an upgrading of approximately 80 wt.% of the bitumen to a liquid product typically in the range of 21 API, (American Petroleum Institute viscosity index). The remaining solid coke product is largely carbon, with the addition of most of the original trace heavy metals, and the catalyst. Though the coke production was higher than in normal coking without catalyst, the resulting liquid product was of much higher quality and suitable for immediate pipe-line introduction.

The second method is called as "*Catalytic Oxidation*". In this process an asphaltene containing heavy crude was heated in air to about 150° C in the presence of air and a specially prepared Au/SiO₂ catalyst. Under these conditions the sulfur containing compounds were converted to sulphones which could then be removed from the resulting in crude in which both the sulfur level was reduced and the asphaltene was destroyed in the process.

Biography

Russell R Chianelli is Professor of Chemistry and Director of the Materials Research and Technology Institute at the University of Texas at El Paso. Formerly a member of Exxon Research and Engineering's Corporate Research Laboratory, he is a world authority on Transition Metal Sulfide Catalytic Materials with over 160 peer reviewed publications and over 60 issued U. S. Patents. His work is highly interdisciplinary and covers theory, experiment and application with commercializations based on his work. In 1990, he was the President of the Materials Research Society and Scientific Leader of the Exxon Valdez oil spill successful bioremediation effort. He has received several recognitions for his work and continues to lead in the understanding of Transition Metal Sulfide catalytic materials and their application to petroleum refining and coal gas catalysis.

chianell@utep.edu