Selective Ring Opening of naphthenic molecules: on the road to upgrade FCC gasoil in a high quality diesel fuel?

Jean-Pierre Gilson

In collaboration with: S. Lecarpentier, M. Houalla, K. Thomas & J. van Gestel

The conversion of light cycle oil (LCO) feedstocks, produced in the FCC unit, to diesel-fuel products requires deep desulfurization and hydrogenation followed by ring opening of the naphthenic cycles to form alkanes (molecules with a higher cetane index). In general, opening of a six-membered naphthenic ring is more difficult than that for a five-membered ring. A suitable catalyst must thus contain an acid function to allow for ring contraction. The cleavage of a C-C bond is, then, followed by hydrogenolysis over the metal. To date, no systematic study of the influence of acidity and metal content on C₆ ring opening activity has been performed. Previous studies have shown that the acidity of zirconia can be modulated with deposition of a controlled amount of W. Hence, a catalytic system consisting of tungstated zirconia and a metal with strong C-C bond cleavage activity such as Ir appears promising. This presentation illustrates a systematic study (preparation, characterization of the metallic and acidic functions by IR spectroscopy and test reactions, kinetic study) of the influence of W and Ir loading on the catalyst activity for selective ring-opening of naphthenic molecules using methylcyclohexane (MCH) as model compound.

It shows that a proper control of the balance between the metallic (Ir) and the acidic (tungstated zirconia) functions yields catalysts with an exceptionally high selectivity in selective ring opening, even at high conversions.

In addition, the preparation of silica-stabilized high surface area zirconia is studied and the causes of its enhanced stability studied by various techniques (IR, NMR spectroscopy and XRD). Such a support is used to increase the zirconia surface area and therefore the acidity of the resulting catalyst.