Catalytic Hydroisomerization of n-Paraffin in Light Naphtha

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Aim of the Work

The petroleum industry is looking for economical solutions to meet new regulatory specifications for producing environmentally clean fuels. Most of the implemented legislation requires a reduction and a limitation on the concentration of benzene in the gasoline pool. This has increased the demand for high performance C_5 and C_6 naphtha isomerization technology because of its ability to reduce the benzene concentration in the gasoline pool while maintaining or increasing the pool octane. The Penex process has served as the primary isomerization technology for upgrading C_5/C_6 light straight run naphtha feeds since 1958. Continuous design, operating and catalyst improvements have kept this process a state-of-the-art technology.

The hydroisomerization and reforming processes are using light and heavy naphtha for transforming the n- paraffins and cyclic compounds included and comprising high proportions of its hydrocarbons to high isomerate yields which have higher octane numbers. Reactions take place on a reactor contained a supported noble metal and a component to provide acidity, the catalyst requires a dry, low sulfur feedstock.

Hydrochlorination of these catalysts has been carried out to modifying the acidity (acid sites number and strength) of the catalysts. Since strong metallic sites and strong acidity are capable of providing both hydrogenation / dehydrogenation activities and isomerization reactions. Although conventional Pt/ Al_2O_3 catalysts enjoy high isomerization activity at relatively lower temperatures (approximately 180 ºC) approach very favorable equilibrium composition characteristics at these temperatures. Again the conventional Aluminum chloride catalysts tend to consume itself by reaction with the feedstock and /or product. When temperature is raised a little in an effort to compensate for loss of catalyst and to speed the reaction to effect more isomerization, light fragments were formed by cracking and these, when vented, caused an excessive loss of the HCl promoter.

In this work, H-ZSM-5(Pentasil) zeolite which has a tridirectional channel structures, and all channels are almost of equal dimensions is chosen as a support for the metals component. Moreover the acid sites in HZSM-5 have a medium strength which has advantage to suppress the hydrocracking reactions.

On the other hand, the metal normally used in the isomerization catalysts is platinum at a concentration of 0.35wt%. The work in this thesis is directed toward discovering the effect of the two most frequently used secondary metals are Pd, Ir either separately or in combination with Pt. The catalysts prepared and studied in this work have been subjected to hydrochlorination or hydroflourination to HZSM-5 loaded with metals.

The choice of n-hexane and cyclohexane has been frequently used as a probe in catalyst preparation. These molecules permits throw light on the mechanisms of the reactions.

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