EFFECT OF TRACE METALS ON FCC COKE YIELD

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An experimental study is underway at the Gulf Research Center in Harmarville, Pennsylvania, aimed at defining the effects of trace metals on the regeneration of fluid cracking catalysts for resid cracking applications. As part of this study a benchscale experimental technique was developed for coking the FCC catalysts under well-mixed conditions. Coke yield was found to correlate well with the type of metal and its concentration.

When contact time was varied the coke yield obeyed the well-known Voorhies-type correlation for each metal:

$$C = AT^{n}$$

where C is weight percent carbon on the catalyst, T is contact time in minutes, A and n are constants. The experimental technique and results obtained for nickel, antimony, and nickel passivated with antimony are discussed in this paper.

The apparatus used for coking consisted of a shaker bomb with a dipleg as shown in Figure 1. The shaker bomb containing a known weight of catalyst was placed in a fluidised sandbath and heated to a typical temperature of 930 F under nitrogen purge. An oil feed was added at a constant rate to the catalyst over a period of time required 1 minute. The internal catalyst temperature was measured by a thermocouple placed at the center of the dipleg. At the end of run the shaker bomb was transferred to another fluidised sandbath maintained at room temperature. The catalyst was then discharged and its carbon content determined. In addition to carbon, the coke was analysed for hydrogen, sulfur, and nitrogen.

Results obtained for nickel, antimony, and nickel passivated with antimony are discussed here. The metals were added, separately and in combined form, to a batch of an equilibrium catalyst at four concentration levels.

Catalysts containing freshly deposited nickel alone showed a steady increase in coke yield with metal content. When antimony was added to passivate nickel on catalyst a reduction in coke make of approximately 40% was obtained. Typical reduction of 50% is reported for commercial units.

Catalysts containing freshly deposited antimony alone did not affect coke yield, regardless of its concentration.

Coking runs made on aged catalysts of high metal content resulted in coke yield lower than that predicted by the correlation developed

for fresh-metals catalysts.

ACKNOWLEDGEMENT

The author wishes to thank Dr. A. S. Krishna of Gulf Research and Development Company for helpful discussions during the course of this study.

REFERENCE

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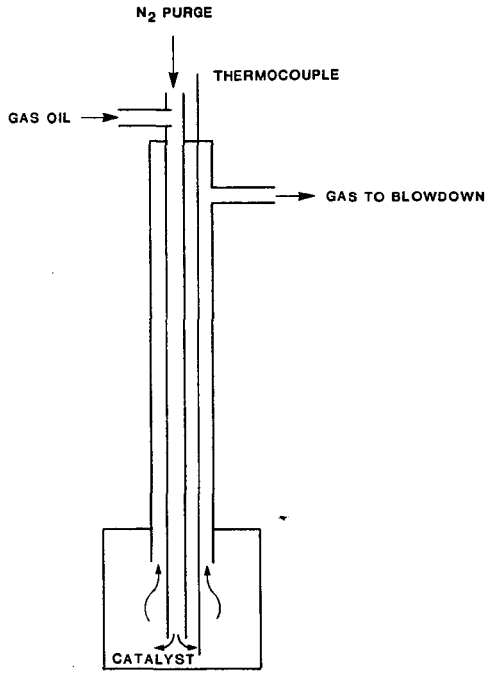

SHAKER REACTOR FOR COKING