

Chapter 4

CONCLUSIONS

The performance of USY, REHY, REY and their composite catalysts was studied in this research. The catalytic activity of prepared catalysts was performed by micro-activity testing (MAT) unit at standard conditions (460°C, cat/oil ratio 3.2, WHSV 16 hr⁻¹) using Fang gas oil (boiling point range 260-340°C) as a feed stock.

The preparation of the USY, REHY and REY zeolites was carried out by firstly synthesizing NaY zeolite, then followed by ion exchange with ammonium and/or rare earth salts. The properties of the prepared zeolites in this work are listed in the following table.

Properties	NaY	USY	REHY	REY
% Crystallinity	102.2	63.71	27.06	29.30
UCS (Å)	24.72	24.38	24.63	24.68
Thermal stability (°C)	937.18	1011.52	1014.86	998.38
Surface area (m ² /g)	652.62	479.75	572.01	575.23
NaO ₂ (%wt)	8.97	0.73	0.89	0.60
RE ₂ O ₃ (%wt)	-	-	10.17	23.81

The catalysts were prepared with varying matrix (PBA and RIPP clay) and zeolite contents (USY, REHY and REY) to demonstrate how matrix and zeolite interact for cracking of gas oil, and their activities were measured by using micro-activity test. Specific conclusions resulting from this research are as follows.

1. An increase in zeolite content of catalysts results in an increase in catalytic activity. For REY and REHY catalysts, when zeolite content increases, gasoline yield increases and slightly decreases when zeolite content is higher than 35 percent by weight due to overcracking.

2. The catalytic performances of REHY and REY containing catalysts shows similar trend. The presence of 20-35% zeolite in catalyst is possible to be an optimum zeolite level for gasoline catalyst. Because at this level, it has high gasoline selectivity and low coke and gas selectivity.

3. Catalyst selectivity is strongly affected by zeolite dealumination. According to the Breck-Flanigan relationship, USY zeolite has the highest silica to alumina ratio, also it has the lowest acid site density in the zeolite. At equal conversion, REY catalyst has gasoline selectivity slightly higher than REHY, while gasoline selectivity of USY catalyst is lower than REY and REHY catalyst. For coke selectivity, REY has the highest (worst) coke yield and USY catalyst has the best coke selectivity.

4. In this work, REY and REHY zeolites have the same catalytic performance. The mixed zeolite catalysts were prepared between REY or REHY with USY. The preferable ratio of zeolite in catalyst should be considered from the high gasoline yield and low coke yield while the conversion is also high. The optimum ratio depends on feedstock, operating conditions and desired products. In general, a higher rare earth content in zeolites results in higher activity, gasoline selectivity, and also in higher coke formation. But the presence of USY in the mixed catalysts will assist in lowering coke yield, while slightly decreasing gasoline yield.