Synthesis of Solid Acid Catalyst from Spent Oil Shale

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Korea is one of the major importing countries of crude oil in the world. Rising imports of crude oil and higher oil prices driven by rising demand, are already threatening the Korean economy.

Research Objective

Synthesis of Solid Acid Catalyst for Oil Shale Processing from Spent Shale

Generate significant quantities of spent shale in need of careful disposal.

Produce low quality oil, requiring additional upgrading process.

Surface Retorting of Oil Shale

An inexpensive solid acid catalyst for oil shale processing was synthesized from spent shale.

Amorphous silica-alumina catalyst was prepared by a simple activation method that basically includes NaOH treatment of spent shale by a fusion method, followed by an ageing process.

Catalytic cracking experiments for polymeric materials were carried out and the performance of the catalyst synthesized was comparable with that of commercial SA catalyst.

This work allows on-site manufacturing of cracking catalyst for retorting of oil shale and upgrading of shale oil.

Summary

Spent Shale

Spent shale is composed of silica and alumina and therefore it can be used as a raw material for solid acid catalysts.

Spent Shale Catalyst 1

- Morphology

Synthesized catalyst showed amorphous feature resulting from the transformation of spent shale, which is observed in the catalyst.

Spent Shale Catalyst 2

- Surface Area and Pore Size

BET surface area is smaller than that of commercial catalysts. This could cause the catalyst synthesized are actually a reverse of active sites and impurities.

Catalytic Activity

- TGA, 5 °C/min, 60 ml/min N₂

The performance of the catalyst in pyrolysis of LDPE was comparable with that of commercial catalysts, demonstrating its effectiveness.

Contact Information

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Oil Shale

USGS Shale

Retorting

Fischer Assay

Spent Shale

NaOH Fusion

Dissolution of Si and Al

Ageing

25 °C Distilled Water (S/L=0.2), 8 h

Washing

Calcing

Oil Shale Catalyst

A Scheme for Oil Shale Processing with Spent Shale Catalyst

Tar Sand

GTL

CTL

Heavy Shale Oil

Five Sisters – Spent shale deposits (Source: EASAC report)