Abstract

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Project Title : Potential of Non-Noble Metals as Substitutes of Noble Metals Supported on Zeolites as Catalysts for Waste Tire Pyrolysis

Investigator : Assoc. Prof. Dr. Sirirat Jitkarnka
The Petroleum and Petrochemical College
Chulalongkorn University

E-mail Address : sirirat.j@chula.ac.th

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In our previous work on waste tire pyrolysis, the selectivity of various catalysts composed of six noble metals and three types of supports were investigated toward the production of various products such as valuable gases, oils, and some petrochemicals. Back then, it was found that most of noble metal-supported catalysts improved the production of such products. Due to a high price of most of the noble metals, it is difficult in economically applying these catalysts in a small- and medium-scale waste tire-pyrolysis plant. In order to develop a cheaper catalyst, non-noble metals (Cu, Zn, Co, Fe, and Ni) were used in this work as alternative promoters on some zeolites with the aims of producing oil and gaseous products at a similar quantity and quality as using a noble metal catalyst. As a result, the non-noble metals were found to give similar activities among themselves; that are, they can outstandingly produce valuable petrochemicals and remove sulfur in oil. They can also be used to substitute noble-metals in various aspects. Fe, Co, and Zn were outstanding in light naphtha production, which can substitute Pt, Pd, and/or Ru. Ni can reduce poly-aromatics in oil, potentially being able to substitute Pt and/or Ru whereas Cu only on HMOR can substitute Ag, Rh, and/or Re in producing cooking gases. Co can substitute Ru, Ag, Rh, and/or Re for light olefins production, and can substitute Pt, Ag, and/or Rh for producing mixed C4s. All test non-noble metals have outstanding activity on enhancing valuable petrochemicals in oil, which can substitute Ru, Rh, and/or Re. Moreover, Cu, Zn, Ni, NiMo, and NiMoS are dominant on removal of sulfur from oil, which can replace Rh and/or Ag. However, it shall be noted that the activities depended on the supports used as well to some extent.

Keywords: Catalysts; Waste tire; Pyrolysis; Tire-derived oil; Petrochemicals