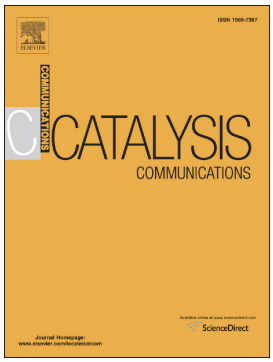

Compensation between activation entropy and enthalpy in reactions of aromatic hydrocarbons catalyzed by solid acids

Koshiro Nakamura, Ryo Mizuta, Satoshi Suganuma, Etsushi Tsuji, Naonobu Katada

PII: S1566-7367(17)30373-4
DOI: doi: 10.1016/j.catcom.2017.08.033
Reference: CATCOM 5182

To appear in: *Catalysis Communications*

Received date: 3 June 2017
Revised date: 26 August 2017
Accepted date: 30 August 2017

Please cite this article as: Koshiro Nakamura, Ryo Mizuta, Satoshi Suganuma, Etsushi Tsuji, Naonobu Katada , Compensation between activation entropy and enthalpy in reactions of aromatic hydrocarbons catalyzed by solid acids. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Catcom(2017), doi: 10.1016/j.catcom.2017.08.033

Compensation Between Activation Entropy and Enthalpy in Reactions of Aromatic Hydrocarbons Catalyzed by Solid Acids

Koshiro Nakamura[a], Ryo Mizuta[a], Satoshi Suganuma[b], Etsushi Tsuji[a] and Naonobu Katada[a*]

[a]Department of Chemistry and Biotechnology, Graduate School of Engineering, Tottori University, 4-101 Koyama-cho Minami, Tottori 680-8552, Japan

[b]Center for Research on Green Sustainable Chemistry, Faculty of Engineering, Tottori University, 4-101 Koyama-cho Minami, Tottori 680-8552, Japan

*Corresponding author: katada@chem.tottori-u.ac.jp Phone/fax +81-857-31-5684

Abstract

Reaction rates of toluene disproportionation (A) and cumene cracking (B) normalized by the number of Brønsted acid sites were analyzed on aluminosilicates. The activation entropy showed linear and compensatory relationship against the activation enthalpy. The slope of entropy-enthalpy plot was in the order of (B) > (A) > small alkane cracking, whereas the intercept on the horizontal axis was in the order of propane and isobutane cracking > linear C4-8 alkanes and iso-pentane cracking > (A) > (B). The former is consistent with the bulkiness of reactant, while the latter is consistent with intrinsic difficulty of formation of intermediate cations.

Keywords: Activation entropy, Activation enthalpy, Zeolite, Silica-alumina, Toluene disproportionation, Cumene cracking.

Introduction

Aluminosilicates including zeolites and amorphous silica-aluminas are important solid acid catalysts [1,2]. Alkane cracking is one of the representative use of the aluminosilicate solid acid catalysts [3-5], whereas various reactions like toluene disproportionation are operated for