

## Catalytic Ring Opening of Decalin – Bifunctional versus Hydrogenolytic Pathways

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### Abstract

Condensed-ring aromatics in diesel and jet fuels possess a number of unfavorable properties such as poor ignition characteristics and cetane numbers, unfavorable cold-flow properties, and a tendency for soot formation. Routes for the selective hydroconversion of polynuclear aromatics into high-value fuel components, in particular mildly branched alkanes, without degradation of the carbon number continue to be a challenge of heterogeneous catalysis. It is generally agreed that such routes would start with a hydrogenation of the aromatic rings to naphthenes, and ring opening would be effected in such saturated structures. Prior work with model hydrocarbons showed that opening of one ring is relatively easy to achieve, but a complete ring opening into alkanes seems to be much more demanding. Only one group [1] reported on the occurrence of open-chain decanes in the hydroconversion of decalin on a Pt,Ir/H-Y zeolite catalyst, but their best selectivity of the desired alkanes was 5 % at 83 % decalin conversion.

In this paper, we report on advanced experimental methods for investigating ring opening of decalin into one-ring naphthenes and open-chain decanes. Typically, products consisting of more than 200 components occur, and reliable peak assignment in the gas chromatograms is mandatory. It will be shown that, depending on the properties of the catalyst, ring opening can proceed either via bifunctional catalysis involving both acid and metallic sites or via hydrogenolysis on the metal. The salient features of both pathways will be demonstrated. In addition it will be shown that with certain noble metal/zeolite catalysts much better selectivities of open-chain decanes can be achieved than so far reported in the literature.

[1] K.C. Mouli, V. Sundaramurthy, A.K. Dalai, J. Mol. Catal. A: Chemical 304 (2009) 77-84.