LETTERS TO THE EDITORS

Comments on "Molecular Traffic Control in Zeolite ZSM-5"

A recent note in this journal (*1*) proposes a novel effect of shape selectivity, designated "molecular traffic control," which may operate in materials containing two types of intersecting channels. Such a material is the zeolite ZSM-5 which has sinusoidal channels of near-circular cross section with a diameter of ~0.55 nm intersecting with linear channels having elliptical openings with dimensions ~0.51 × ~0.55 nm (*2, 3*).

Derouane and Gabelica (*1*) have suggested that, for materials with appropriate channel dimensions and where reactant and product molecules differ in size, "molecular traffic control" may result in a one-way flow of molecules through the smaller channels. Such a situation would imply zero counterdiffusion and thus "molecular traffic control" has been used to explain the absence of counterdiffusional limitation on the rate of the methanol-to-hydrocarbons reaction over zeolite ZSM-5.

The diffusional scheme proposed (*1*) for the conversion of methanol into hydrocarbons (*4*) is based on the assumption that methanol molecules are the only species which can diffuse along the smaller channels of ZSM-5. It is unlikely that this assumption is correct, as one molecule of water is produced for each molecule of methanol converted and it is improbable that water would not be able to diffuse out through channels large enough to allow the ingress of methanol. Furthermore, the reaction

$$n\mathrm{CH_3OH} \rightarrow n\mathrm{H_2O} + \text{hydrocarbon}$$

is accompanied by an increase in the total number of molecules in the system, rather than the decrease mentioned in the development of the scheme. We are thus of the opinion that, for methanol conversion, complete absence of counterdiffusion in the smaller channels of ZSM-5, due simply to steric factors, is improbable.

Nevertheless, the concept of "molecular traffic control" in materials with two types of intersecting channels is novel and the phenomenon may well operate for reactions such as addition oligomerizations, where all product molecules are larger than reactants. Similarly, "reverse molecular traffic control," in which small product molecules diffuse from the catalytically active sites preferentially via channels which do not permit passage of larger reactants, may also be possible.

REFERENCES

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