ECN-RX--05-144

INVESTIGATING ZEOLITE LOCAL STRUCTURE WITH ADVANCED SOLID STATE NMR: as-SYNTHESIZED ZSM-5 AND Fe-ZSM-5

Ernst R.H. van Eck, J.A.Z. Pieterse, A. Abraham, J. van Bokhoven, and Arno P. M. Kentgens

Proceedings of the Netherlands Chemistry and Catalysis Conference, 7-9 March 2005, Noordwijkerhout

Oral presentation

August 2005

INVESTIGATING ZEOLITE LOCAL STRUCTURE WITH ADVANCED SOLID STATE NMR: AS-SYNTHESIZED ZSM5 AND FE-ZSM5

Ernst R.H. van Eck[1], *J.A.Z. Pieterse[2], A. Abraham[3], J. van Bokhoven[3], and Arno P. M. Kentgens[1]*

[1]Department of Physical Chemistry, Solid State NMR, Institute for Molecules and Materials, Radboud University Nijmegen, 6525 ED Nijmegen, the Netherlands
[2]ECN Clean Fossil Fuels, Hydrogen Technologies & Applied Catalysis, Westerduinweg 3,P.O. Box 1, 1755 ZG Petten, the Netherlands
[3] Institute for Chemical and Bioengineering, ETH Zurich ETH-Hoenggerberg, HCI CH-8093 Zurich Switzerland

Zeolites are porous materials that have a major impact and use in the areas of catalysis (e.g. hydro-cracking), ion exchange (e.g. pollution remediation) and are extensively used as molecular sieves. Despite extensive research, some aspects of zeolites are still not well understood. Here some recent results obtained for a variety of zeolites are presented, illustrating the advantage of using higher field solid state NMR in this area of research.
Different catalytic properties can be gained by exchanging the charge balancing protons for other ions or by loading the zeolite with metals in a variety of ways. Iron-exchanged zeolites are an important example, especially Fe-ZSM-5, and are being studied for use as DeNOx catalysts in lean-burn gasoline and diesel engines and also for N_2O decomposition and reduction. In order to study the interaction between iron and the zeolite lattice, Fe-exchanged ZSM5 is investigated by ^{27}Al MQMAS NMR in its dried and hydrated state. The results indicate that some of the aluminium associated with the Bronsted sites participate in the ion exchange while others are not.
In as-synthesized ZSM-5 the interaction between the template molecule around which the zeolite lattice builds and aluminium located in the lattice is clearly illustrated with the TRAPDOR technique. It indicates that the aluminium and methyl carbons in one type of channel are much closer than in the other type of channel.

E-mail: erhve@nmr.kun.nl
www: http://www.solmr.sci.kun.nl/