Characterization of Chemical Properties, Unit Cell Parameters and Particle Size Distribution of Three Zeolite Reference Materials

Microporous aluminosilicate zeolites have widespread industrial application. Despite the considerable industrial application of zeolites and the ongoing research into new applications, development of standards for intercomparison of research has been limited. Only one standard has been produced (ERM-FD107) in which only the micropore volume and median pore width have been certified. To address this gap, NIST has produced three new zeolite Reference Materials (NIST RMs).

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Traditionally, zeolites are used as catalysts for cracking of high molecular mass hydrocarbons to shorter-chain hydrocarbons in the petrochemical industry, for water softening in powder laundry detergents, as drying agents of organic solvents, for waste water treatment, and for gas separations. More advanced applications for zeolites being investigated include use as chemical sensors, as molecular sieve membranes, for long-term toxic waste storage, as nonlinear optical materials, and as hosts for semiconductor quantum dots, molecular wires, and lasing dyes. The new zeolite Reference Materials have been characterized by a variety of chemical and physical measurement techniques: X-ray fluorescence, gravimetry, instrumental neutron activation analysis, nuclear magnetic resonance, calorimetry, synchrotron X-ray diffraction, neutron diffraction, laser light extinction, laser light scattering, electric sensing zone, X-ray sedimentation, transmission and scanning electron microscopy and optical microscopy. The chemical homogeneity of the materials has also been characterized.

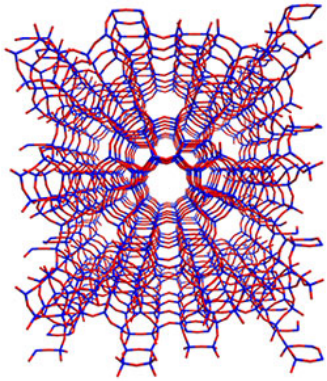
Reference values are given for the major and trace element concentration and for the Si/Al and Na/Al ratios. Information values are given for enthalpy of formation, unit cell parameters, particle size distribution, and refractive indices. A major challenge in the development of the reference materials is their hygroscopic nature. Experiments were conducted to: 1) determine the approximate change of mass of the zeolite materials with variation in ambient relative humidity (RH) and 2) test an assumption that the zeolites would reach a stable mass within 48 h in an relative humidity (RH) of ≈ 50 %. The testing provided a methodology for conducting the measurements.

Three zeolite materials have been characterized by the National Institute of Standards and Technology as Reference Materials (RMs):

- Zeolite Y (RM 8850),
- Linde Type A (RM 8851)
- ZSM-5 (RM 8852)

These RMs will provide a basis for intercomparison studies of these zeolite materials by analytical laboratories.

Future Plans: The RMs should be issued early in 2006. There are over 1000 units of each material available for distribution. Depending upon interest, there is the possibility of characterization of other zeolite materials.



Zeolites contribute to a cleaner, safer environment in a great number of ways. In fact nearly every application of zeolites has been driven by environmental concerns, or plays a significant role in reducing toxic waste and energy consumption.

Source: **British Zeolite Association**

Source of graphic: **Zeolite ZSM-5 @ 3Dchem.com**

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