Experimental report for proposal CH-5440

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Beamline: ID15B

The high-pressure behavior of six synthetic zeolites with the MFI topology, characterized by different chemical composition (framework-Si partially replaced by Al or B and counterbalanced by Na or H as extra-framework cations), has been investigated by *in-situ* powder synchrotron X-ray diffraction at the beamline ID15B of the European Synchrotron radiation source, using *silicone-oil* and *methanol* as hydrostatic pressure-transmitting fluids. For each sample, the compressibility in *silicone-oil* has been found to be considerably higher than that in *methanol*. This difference in terms of bulk elasticity is due to the adsorption of methanol already at $P < 0.1$ GPa, with different magnitudes as a function of the sample crystal-chemistry. The high number of experimental pressure points allowed an accurate determination of the monoclinic-to-orthorhombic phase transition (MOPT), detected between 0.3 and 0.7 GPa in the samples compressed in *silicone-oil*, whereas the orthorhombic *Pnma* polymorph has been found to be stable already at ~ 0.1GPa in four samples compressed in methanol. This suggests that the adsorption of methanol may increase the *P*-stability range of the orthorhombic *Pnma* phase. A comparative analysis of the effect of pressure on the methanol adsorption by MFI-zeolites with different chemical composition is provided, which offers potentially useful information on their application as catalysts in the methanol-to-olefins conversion processes and in industrial high-pressure processes.

The obtained results have been published in the peer-review journal *Catalysis Today*, doi: https://doi.org/10.1016/j.cattod.2019.10.007.

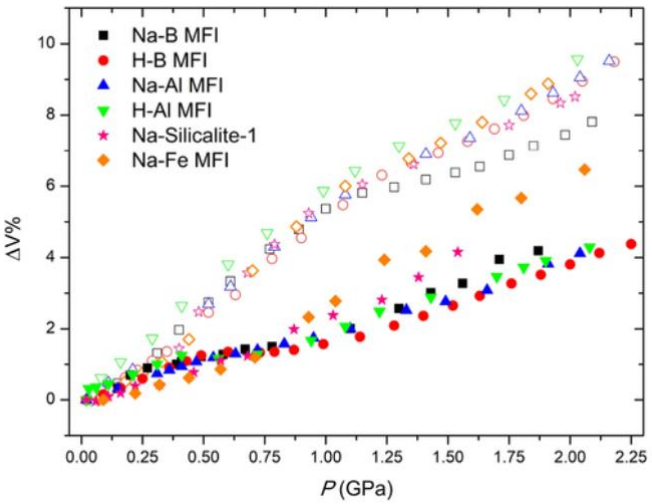

Figure: *P*-induced evolution of the volume variation (in %) for the six studied MFI-zeolites compressed in silicone oil (empty symbols) and methanol (full symbols).