

ULTRATHIN COATINGS OF EXFOLIATED ZEOLITE NANOSHEETS ON POROUS AND NON-POROUS SUPPORTS

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Sustainable technologies are needed to replace energy inefficient separation processes, such as distillation and crystallization. Distillation alone is responsible for nearly 40% of total consumed energy in the chemical industry. Separation using membranes is a promising, energy efficient alternative. Zeolites are especially attractive as membrane materials. These aluminosilicates have well-defined cages and channels built into the crystal structure as well as high chemical and thermal stability. The size range of the cages and channels in the zeolite structure is 3-20 Å, similar to the sizes of many industrially important molecules. Therefore, membranes fabricated using zeolites can selectively sieve various gases and hydrocarbon vapors. Further, thin zeolite films made using exfoliated zeolite nanosheets have the potential for outstanding performance by creating a combination of high flux and selectivity.

Here we report exfoliation of zeolite nanosheets from their layered as-grown zeolite precursor and subsequent coating of these nanosheets on porous and non-porous supports using filtration and evaporation assisted self assembly. Exfoliation of nanosheets by a melt shearing process was confirmed by transmission electron microscopy and X-ray diffraction. Scanning probe microscopy indicated that zeolite nanosheets were 1.5 unit cell (~ 3.4 nm) thick along their *b*-axis. The coating morphology, characterized by scanning electron microscopy, revealed that a

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coating prepared by filtration on a porous support consisted of well packed, overlapping nanosheets (Figure 1). Films made on porous supports separated equimolar feed of *p*-xylene and *o*-xylene with the separation factor of 40-70 after a very mild hydrothermal treatment (Varoon *et al.*, 2011).

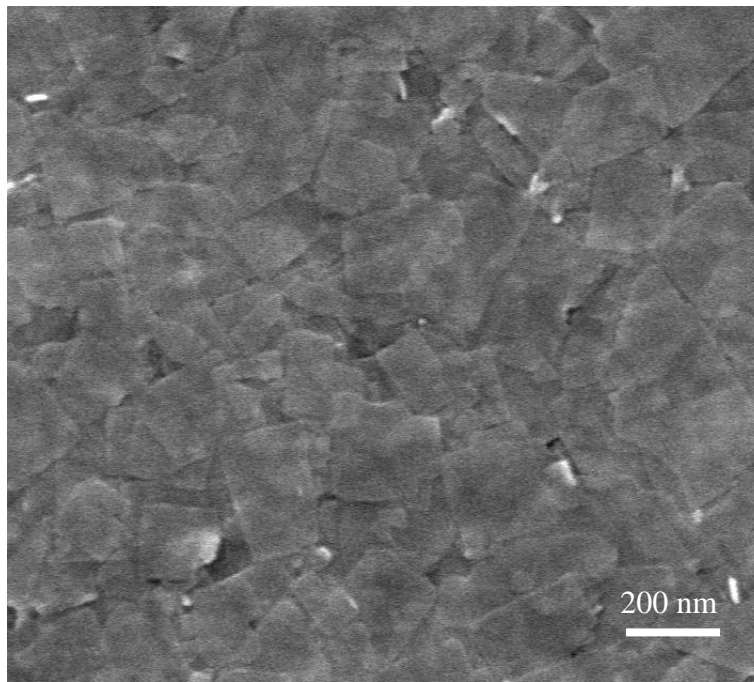


Figure 1: SEM of zeolite nanosheet coating with b-axis orientation on a porous support

Reference:

K. Varoon, X. Zhang, B. Elyassi, D. D. Brewer, M. Gettel, S. Kumar, J. A. Lee, S. Maheshwari, A. Mittal, C. Y. Sung, M. Cococcioni, L. F. Francis, A. V. McCormick, K. A. Mkhoyan, M. Tsapatsis, “Dispersible Exfoliated Zeolite Nanosheets and Their Application as a Selective Membrane”, **Science**, 334, 72, 2011