AEI SAPO-18 (DPEA method) Al(49), P(42), Si(9)

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Type Material $[Al_{24}P_{20}Si_4O_{96}]$: mR: nH_2O (R = N,N-diisopropylethylamine)[b]

Method J. Chen, P. A. Wright, J. M. Thomas, S. Natarajan, L Marchese, S. M. Bradley, G. Sankar, C. R. A. Catlow [1]

Batch Composition 0.40 SiO_2 : Al_2O_3 : 0.90 P_2O_5 : 50 H_2O : 1.60 R

Source Materials

distilled water
phosphoric acid (Aldrich, 85% H_3PO_4)
aluminum hydroxide hydrate (Aldrich, Ca. 55% Al_2O_3)
Aerosil (Degussa, 99% SiO_2)
N,N-diisopropylethylamine (Aldrich, 99% $C_8H_{19}N$)

Batch Preparation (for 2 g product)

[1] [19.4 g water + 3.48 g phosphoric acid + 4.64 g aluminum hydroxide hydrate], stir until homogeneous
[2] [(1) + 0.60 g Aerosil], stir until homogeneous
[3] [(2) + 5.10 g N,N-diisopropylethylamine], stir until homogeneous

Crystallization

Vessel: PTFE-lined stainless steel autoclave
Temperature: 160°C
Time: 8 days
Agitation: none

Product Recovery

(1) Filter; wash with distilled water
(2) Dry at 50°C in air
(3) Yield: 60% based on Al_2O_3

Product Characterization

XRD: [c] Characteristic strong reflections at d = 9.1 and 5.1 Å for as-synthesized materials;
competing phase is AFI when $P_2O_5/Al_2O_3 > 1.2$ or $R/P_2O_5 < 1.2$
Elemental Analysis (exclusive of R and H2)): 0.35 SiO_2 : Al_2O_3 : 0.87 P_2O_5
Crystal Size and Habit: small cubes less than 2 μm in diameter

References

[1] J. Chen, P. A. Wright, J. M. Thomas, S. Natarajan, L Marchese, S. M. Bradley, G. Sankar, C. R. A. Catlow, J. Phys. Chem. 98 (1994) 10216
[2] A. Simmen, L. B. McCusker, Ch. Baerlocher, W. M. Meier, Zeolites 11(1991) 654

[3] S. T. Wilson, B. M. Lok, C. A. Messina, T. R Cannan, E. M. Hanigen, J. Am. Chem. Soc. 104 (1982) 1146
[4] H. He, J. Klinowski, J. Phys. Chem. 97 (1993) 10385

Notes

a. Preparation for SAPO-18 only is given. For AlPO4-18 [2], no Aerosil is added, and the amounts of reactants should be changed to give gel composition Al_2O_3 : P_2O_5 : 50 H_2O : 1.80 R

b. $AlPO_4$-18 was originally prepared by using tetraethylammonium hydroxide (TEA-OH) as the template m the presence of HCl. It is not possible to prepare SAPO-18 using (TEA)-OH. [3, 4]

c. The XRD patterns of the AEI materials are very sensitive to water molecules present in the channels of the structure.

d Crystals are typically cubic; crystal size increases to a certain degree as the amount of silica in the reaction mixture increases.