

NAT

[Ga] Natrolite

Si(62), Ga(38)

Contributed by Mario Occelli

Verified by I. Buhl and by R Aiello

Type Material (NaK₈R₆)[Ga₁₅Si₂₅O₈₀] · wH₂O (R = benzyl trimethylammomum (BTMA))

Method M. L. Occelli, E. Goldish, H. Eckert [1]

Batch Composition 5.30 Na₂O : 2.21 K₂O : 2.12 R₂O : Ga₂O₃ : 12.54 SiO₂ : 298 H₂O : 31.4 CH₃OH

Source Materials

deionized water

sodium hydroxide, reagent grade (~97% NaOH)

potassium hydroxide, reagent grade (85% KOH)

gallium oxide (99.99% Ga₂O₃)

sodium silicate (PQN-brand, 29,9% SiO₂, 10.0% Na₂O)

benzyl trimethyl ammonium hydroxide (Excel Co., 40% in methanol)

Batch Preparation

- (1) [50 g water + 9.92 g sodium hydroxide + 29.0 g potassium hydroxide] mix until dissolved
- (2) [(1) + 18.7 g gallium oxide], stir at the boiling point until the solution clears
- (3) [(2) + 50 g water], mix and cool to ambient temperature
- (4) [(3) + 167.2 g BTMA. OH solution]
- (5) [251.3 g sodium silicate + 274.3 g water] mix for 4 hours
- (6) [(5) + (4)], add gallate mixture dropwise to the vigorously stirred, diluted sodium silicate; stir for 10 hours at ambient temperature

Crystallization

Vessel: Teflon-lined, stirred autoclave

Incubation: 10 h at ambient temperature with stirring

Temperature: 125 ± 2 °C

Time: 7 days

Agitation: 100 rpm

Product Recovery

- (1) Filter and wash to pH < 10
- (2) Dry at 110 °C
- (3) Yield: near 100% on Ga₂O₃

Product Characterization

XRD: NAT; no other crystalline phases or amorphous material observed

Elemental Analyses: Ga₂O₃ : 3.28 SiO₂ : 0.11 Na₂O : 0.56 K₂O : 0.39 (BTMA)₂O

Crystal Size and Habit: Anisotropic columns 10-20 μm long with an almost square cross section often bounded at both ends by pyramids. Twinning and intergrowths are common

Reference

- [1] M. L. Occelli, L. Goldish, H. Eckert, in *Stud. Surf. Sci. Catal.* 84, J. Weitkamp, H. G. Karge, H. Pfeifer, W. Holderich (eds.), 1994, p. 597

Note

- a. Diluted gallate solution must be clear.