

**Contributed by** Eng-Poh Ng

**Verified by** I. Kondofersky, A. Khartchenko, D. Wales

**Type Material:**  $[\text{Na}^+_{14} \text{K}^+_{2} (\text{H}_2\text{O})_{27}] [\text{Al}_9\text{Si}_{27} \text{O}_{72}]$

**Method:** E.-P. Ng, D. Chateigner, T. Bein, V. Valtchev, S. Mintova [1]

**Batch Composition** 5.15 SiO<sub>2</sub> : 1 Al<sub>2</sub>O<sub>3</sub> : 17.6 Na<sub>2</sub>O : 222 H<sub>2</sub>O

#### Source Materials

distilled water

sodium hydroxide (99%, Merck)

sodium aluminate (56.7% Al<sub>2</sub>O<sub>3</sub>, 39.5% Na<sub>2</sub>O, Strem-chemicals)

sodium silicate (29% SiO<sub>2</sub>, 8% Na<sub>2</sub>O, Prolabo)

#### Batch Preparation

- (1) [100.00 g water + 1.61 g sodium hydroxide + 9.047 g sodium aluminate], stir in a plastic flask until dissolved
- (2) [(1) + 44.00 g sodium hydroxide], stir until dissolved, cool with ice bath<sup>a</sup>
- (3) [57.692 g sodium silicate + 20.00 g sodium hydroxide + 80.00 g H<sub>2</sub>O], stir until dissolved, cool with ice bath<sup>a</sup>
- (4) Add (2) slowly into (3) under vigorous stirring, keep stirring for 5 min<sup>b</sup>

#### Crystallization

Vessel: 250 mL polypropylene bottle

Temperature: 30 °C

Time: 36 hours

Agitation: none

#### Product Recovery

- (1) Dilute reaction mixture with water
- (2) Centrifuge and wash with water until pH 7.5
- (3) Dry at 60°C in conventional oven or freeze-dry
- (4) Yield: approximately 14 g

#### Product Characterization

XRD: EMT; competing phase<sup>c</sup>: SOD, FAU (when prolonging aging time)

Elemental analysis: 52 SiO<sub>2</sub> : 22 Al<sub>2</sub>O<sub>3</sub><sup>c</sup>

Crystal size and habit: hexagonal thin plate-like crystals with a size of 10-15 nm

#### References

- [1] E.-P. Ng, D. Chateigner, T. Bein, V. Valtchev, S. Mintova, *Science* 335 (2012) 70
- [2] E.-P. Ng, J.-M. Goupil, A. Vicente, C. Fernandez, R. Retoux, V. Valtchev, S. Mintova, *Chem. Mater.* 24 (2012) 4758

**Notes**

- a. Clear solutions are obtained
- b. White cloudy solution slowly forms
- c. According to Ref [2]