

## Synthesis and characterization of nanofibrous sodium manganese oxide with a 2 x 4 tunnel structure

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### Abstract:

Sodium manganese oxide octahedral molecular sieves with a 2 x 4 tunnel structure (Na-2 x 4) have been hydrothermally synthesized from Na-birnessite materials at low temperatures and pressures. The synthetic template materials, the pH value of the medium, and the autoclaved temperature are critical in the synthesis. Sodium salts, such as NaCl, NaNO<sub>3</sub>, and Na<sub>2</sub>SO<sub>4</sub>, are good templates for Na-2 x 4. In strong basic solution or below 160 degreesC, Na-birnessite does not transform to the Na-2 x 4 structure. TEM images show the synthesized Na-2 x 4 is made up of thin slablike single crystals elongated along the b axis. The formula of Na-2 x 4 can be written as Na<sub>0.33</sub>Mn<sub>0.333</sub>+Mn<sub>0.674</sub>+O<sub>2</sub>. xH<sub>2</sub>O, and it is monoclinic with space group C2/m. The unit cell parameters (a, b, c, and beta) for Na-2 x 4 are 14.434(5) Angstrom, 2.849(7) Angstrom, 23.976(6) Angstrom, and 98.18 degrees, respectively. These data for Na-2 x 4 are slightly different from the data for Rb-2 x 4 synthesized under high pressure and high temperature, which were reported by Rziha et al. (Eur. J. Miner. 1998, 8, 1155-1161). The surface area of Na-2 x 4 is about 57 m<sup>2</sup>/g. Na-2 x 4 materials are thermally stable up to 450 degreesC as indicated by TGA and TPD data.