

The formation of nanostructured CaTiO_3 by the hydrothermal treatment of a Na–Ti-based one-dimensionally nanostructured precursor



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Aim

The hydrothermal synthesis of one-dimensionally nanostructured CaTiO_3 .

Experimental

- Hydrothermal synthesis of 1D Na–Ti-based precursor:

TiO_2 (Anatase) and 10M NaOH
165°C/72h

- Hydrothermal intercalation of Ca^{2+}

Na–Ti-based precursor and excess of $\text{Ca}(\text{OH})_2$
100°C/12h, 200°C/24h

Idea

One-dimensional nanostructured precursor

Structure

Morphology

Incorporation of calcium in the precursor structure

Preservation of the morphology

Change of the chemical composition

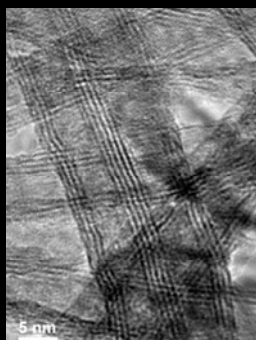
One-dimensionally nanostructured CaTiO_3

Results

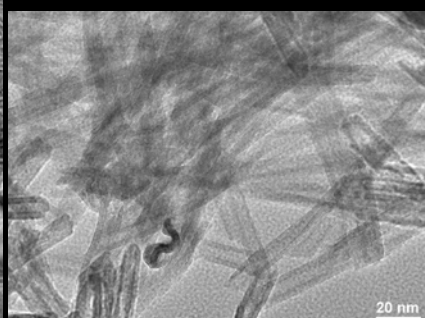
The hydrothermally synthesized Na–Ti-based precursor
165°C/72h

EDS analysis of the precursor

Na (at%)	5.0
Ti (at%)	30.8
O (at%)	64.2

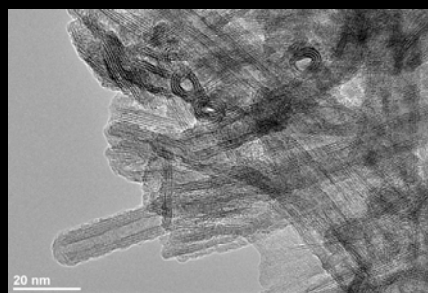


Nanotubes



The hydrothermal incorporation of Ca^{2+} in the structure of Na–Ti-based precursor
100°C/12h

Nanotubes



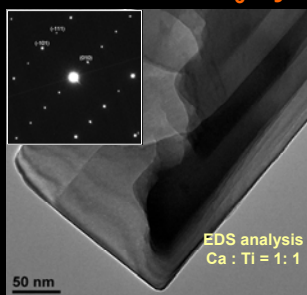
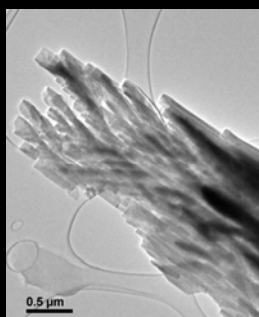
EDS analysis of nanotubes

Na (at%)	1.4
Ca (at%)	10.5
Ti (at%)	25.6
O (at%)	62.5

The hydrothermal incorporation of Ca^{2+} in the structure of Na–Ti-based precursor

200°C/24h

Single crystalline CaTiO_3 crystals



Summary

- the hydrothermal treatment of Na–Ti-based nanotube precursor at 100°C is suitable for the preparation of Ca–Ti-based nanotubes and
- leads to the formation of CaTiO_3 single crystalline, well crystallized nanocrystals at 200°C
- Na – Ti-based 1D nanostructures exhibit photocatalytic activity in UV spectra

Potential Applications

- Na–Ti-based nanotubes: ion-exchange processes, photocatalytic reactions in UV and visible spectrum, fuel-cell electrolytes, gas sensors, ...
- use of platelike CaTiO_3 particles as a template in the templated grain growth method