NASTAROD

Nanoparticles in Aqueous Suspensions for TunAble and Reconfigurable Optical Devices

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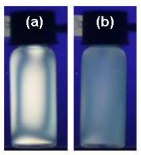
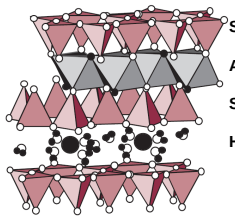
DYNAMIC OF ELECTRO-OPTIC EFFECT OF AQUEOUS SUSPENSIONS OF BEIDELLITE & GOETHITE CLAY

- Study of aqueous suspensions of clay nanoparticles in isotropic phase
- Evaluating applications of these materials in optical telecommunication issue

Beidellite structure



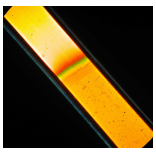
Beidellite Mesophases



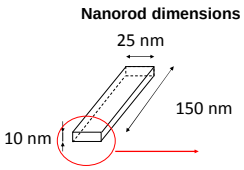
Ø 200 ou 300 nm
e ~ 0.6 ou 0.9 nm

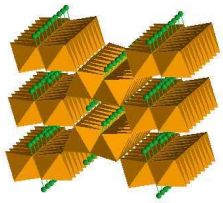
Goethite structure

goethite (a-FeOOH) nanorods



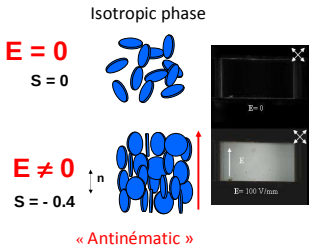
Goethite Mesophases

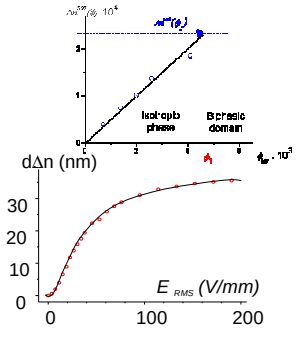




Crystalline structure : *Fe* in octaedric sites

Electro-optic effect with Beidellite

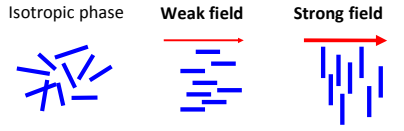


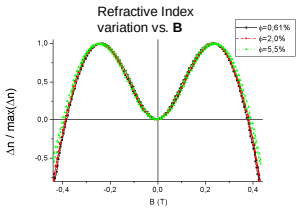


Induced birefringence: $\Delta n(E) = \Delta n^{sat} . \phi . S(E)$

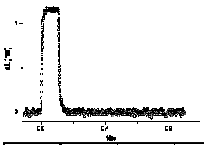
Φ: Volume fraction, S: order parameter

Magneto-optic effect with Goethite





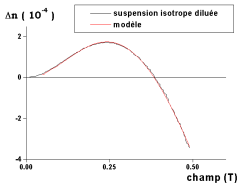
Beidelite: Dynamics of E.O effect



ϕ(%)	Urms (V)	d.Δn (nm)	τsat (ms)
0.07	70	1.084	3.6
0.16	70	1.873	7.9
0.21	70	4.517	7.8
0.26	70	7.165	12.3
0.33	70	11.44	32.3
0.45	70	19.044	837.0
0.56	70	17.592	605.9

$\Delta n_{max} = 2.10^{-4}$

Goethite: Dynamics of E.O effect

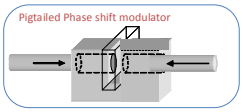


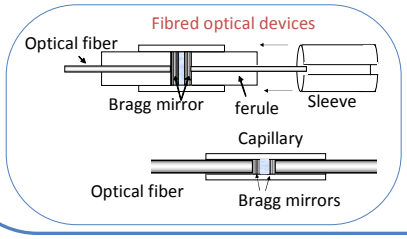
$\Delta n_{max} = 10^{-3}$

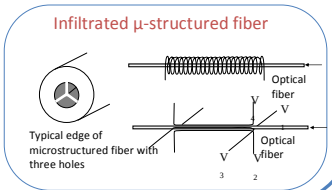
Optical Telecommunication Applications

Example of optical devices:

Optical Filter, optical group delay line







Advantages of clay suspensions

- Low-cost material
- Isotropic phase: Light Polarization insensitive
- Potentially Large index amplitude modulation
- Response times compatible with Telecom optical functions: reconfiguration & restoration: ≈50ms

Production scientifique:

« Dynamic of electro-optic effect of aqueous suspensions of Beidellite clay », L. Michot, P. Antonini, I. Dozov , L.Dupont, ELOPTO2012

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