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INFRARED SPECTROSCOPIC STUDY OF WATER CONFINEMENT IN STANDARD AND HYBRID IMOGOLITES

YUAN YUAN. LIAO (1),* PIERRE. PICOT (1), JEAN-BLAISE. BRUBACH (2), PASCALE. ROY (2), ANTOINE. THILL (1), SOPHIE. LE CAËR (1)

(1) CEA/Saclay, DRF/IRAMIS/NIMBE/LIONS UMR 3685, Bat.546, F-91191, Gif-sur-Yvette Cedex, France

(2) Synchrotron SOLEIL AILES Beamline, L'Orme des Merisier, Saint-Aubin, BP 48, F-91192, Gif-sur-Yvette Cedex, France

Imogolite is a family of aluminium silicate clay minerals, originally found in volcanic soils. Their nanotubular structure makes them good candidates for the study of water confined in restricted geometries. The behaviour of water confined in imogolite self-sustaining thin films, whose porosity was estimated, was studied by means of infrared (IR) spectroscopy. Two types of synthetic imogolites were studied: a hydrophilic imogolite (IMO-OH) with a hydrophilic inner surface fully covered with Si-OH groups and a hybrid imogolite (IMO-CH_3) with a hydrophobic inner surface fully covered with Si–CH_3 groups. The infrared spectra were recorded in the 50 - 4000 cm^{-1} range as a function of the relative humidity (0 - 100% RH) and temperature (295 K to 50 K). The evolutions of the O-H stretching band, and the bending, libration and connectivity bands of water were studied. The special features of the H-bond network revealed in both the mid- and far- IR range during the water adsorption and desorption processes will be detailed, evidencing that the water confinement in imogolites is significantly affected by the geometry of the nanotube, the packing of the tubes, and also by the hydrophobic vs. hydrophilic character. Insights into the relationship between (1) the large specific surface area, (2) restricted geometries, (3) the tunable hydrophilic/hydrophobic character, can serve the scientific community interested in deploying these materials as membranes, catalyst supports, adsorbents and other similar applications [1, 2].

References:

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