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Société Française de Minéralogie et de Cristallographie

A TRIBUTE TO PROFESSOR HUBERT CURIEN

Organized by the Institut de Minéralogie et de Physique des Milieux Condensés (IMPMC), the Association Française de Cristallographie (AFC) and the Société Française de Minéralogie et de Cristallographie (SFMC)

On June 19, over eighty persons gathered at IMPMC in Paris to remember the outstanding contribution of Hubert Curien to mineralogy and crystallography. Professor Hubert Curien, who died on February 6, 2005 at the age of 80, exercised countless responsibilities in the French and European research administrations, including the C.E.R.N. and the European Space Agency (of which he was the first president). In addition, he acted as Minister of Research and Technology in France. He was president of the SFMC in 1967 and of AFC in 1969. During this meeting, we commemorated Hubert Curien as an outstanding professor (he never stopped teaching) and a distinguished mineralogist and crystallographer. In the presence of Ms Curien, many of his former students and colleagues testified as to how Hubert Curien has influenced their lives, by his example, by his care, by his advice, etc. His scientific contribution was illustrated by a few selected examples: defects in solids like LiF, inelastic scattering of X-rays in bcc iron, the formation of twins, and so on. In many cases, the work of Hubert Curien was precursory, and several current fields in solid-state physics and geophysics bear the imprint of this generous man.

A NEW RAMAN DATABASE ONLINE ON THE SFMC WEBSITE

Raman spectroscopy is a very powerful tool to rapidly characterize minerals. However, databases on Raman spectra are relatively scarce. The SFMC is happy to contribute to the international dataset by presenting a new Raman database, collected primarily by Claire Bény (BRGM), together with Jean-Michel Bény (BRGM, University of Orléans and CNRS) and Bernard Lasnier (Nantes University).

Visit the new Raman database at http://www.sfmc-fr.org/main/raman.htm and send all remarks to sfmc@ccr.jussieu.fr

You are also invited to contribute by providing new spectra. The following information is associated with each spectrum: analytical conditions of acquisition, characteristic wavenumbers, and structure of minerals.

PRIX HAÜY-LACROIX 2006

Hélène Gailhanou

Each year the SFMC awards the Prix Haüy-Lacroix to recognize a young scientist for the quality of his PhD research in the fields of mineralogy, geochemistry, petrology, or material science. In 2006, it was awarded to Hélène Gailhanou. She completed her PhD at the Laboratoire TECSEN – Université d'Aix-Marseille III, with J. Olives and J. Rogez as advisors. Dr Gailhanou is now a postdoctoral fellow at the BRGM in Orléans (contact: H.Gailhanou@brgm.fr). The following is a summary of her study entitled "Experimental Determination of Thermodynamic Properties and Study of Nanostructures of Clay Minerals."

Clay minerals such as smectite and interstratified illite–smectite are particularly well-adapted for natural or engineered barriers in waste confinement. Nevertheless, data concerning their thermodynamic properties, essential for understanding their chemical behavior over long time periods, are rare and of questionable value.

For the first time, all the thermodynamic functions of internationally referred clay minerals—illite IMt-2, smectite MX-80, interstratified illite–smectite ISCz-1—and the mixed-layer illite–smectite series of Shinzan (Japan) have been determined. The study of nanostructures by HRTEM-EDX has provided very original results (e.g. presence of trioctahedral illite) and has led to an accurate redefinition of these minerals.

The minerals were studied in the anhydrous and hydrous states. A preliminary study of hydration was carried out on smectite MX-80 and interstratified ISCz-1. For the first time, water vapor adsorption isotherms have been obtained at various temperatures, from 25°C to 105°C.

The enthalpies of formation of minerals were determined from the enthalpies of dissolution in an HF–HNO_3 solution at 25°C of (1) the sample (mineral + impurities) and (2) the mixed oxide or hydroxide constituents (of the mineral) + impurities.

The enthalpies of mixing of illite and smectite layers were obtained by calorimetry of dissolution on Shinzan mixed-layer series. They are slightly negative, with a minimum value of 3.7 kJ/mol $O_{10}(OH)_2$ for 50% illite–50% smectite. Mixed-layer minerals are therefore slightly more stable than the assemblage of the two end-members, illite and montmorillonite.

Heat capacities were obtained by adiabatic calorimetry, from 5K to 380K, and by differential scanning calorimetry, from 300K to 500K. The values were corrected by subtracting the contribution of impurities. Water in hydrous clay minerals undergoes one or two continuous glass transitions between 150 and 270K. They may correspond to different types of adsorbed water. From C_p values, entropies and enthalpies of heating were calculated.

Gibbs free energies of formation were obtained from enthalpies and entropies of formation at various temperatures. In particular, Gibbs free energies of formation from oxides are negative, which shows that clay minerals are more stable than the association of the corresponding oxides.

By comparing the values obtained for anhydrous and hydrous minerals, enthalpies of hydration and Gibbs free energies of hydration were calculated.

At the same time, equilibrium experiments of clays in aqueous solutions were carried out. The values of ionic activity products obtained after two years, for various clay–solution systems, were compared with calorimetric results.