

## STRUCTURE ELUCIDATION OF KAOLINITE INTERCALATION COMPLEXES BY ADVANCED INSTRUMENTAL TECHNIQUES

KRISTÓF, J.,<sup>1</sup> FROST, R. L.,<sup>2</sup> HORVÁTH, E.<sup>3</sup>

<sup>1</sup> Department of Analytical Chemistry, University of Veszprém [Analitikai Kémia Tanszék, Veszprémi Egyetem], POB 158, Veszprém, 8201, Hungary

<sup>2</sup> Inorganic Materials Program, School of Physical Sciences, Queensland University of Technology, POB 2434, Brisbane, Queensland, 4001, Australia

<sup>3</sup> Department of Environmental Engineering and Chemical Technology, University of Veszprém [Környezetmérnöki és Kémiai Technológia Tanszék, Veszprémi Egyetem], POB 158, Veszprém, 8201, Hungary  
E-mail: kristof@almos.vein.hu

Although organoclay complexes occur everywhere in nature, the systematic study of clay-organic interactions started only at the beginning of the last century using mainly X-ray diffraction and DTA techniques (Yariv and Cross, 2002). From the early sixties, simultaneous TG-DTG-DTA analysis (by means of the Derivatograph) opened a new chapter in this field of research.

During the last decades of the century the appearance of highly sophisticated instruments (e.g. TG-MS, FTIR, Raman microscope) contributed enormously to the progress of clay science. This “interdisciplinary” approach offered the possibility of setting up more refined structural models for e.g. intercalation complexes based on the reliable measurement data of complementary nature.

In the present paper the potential of this multi-method approach is demonstrated via the investigation of hydrazine-intercalated kaolinites using XRD, TG-DTG-MS, CRTA, FTIR and Raman microspectroscopy (Kristóf et al., 2002; Horváth et al., 2003; Frost et al., 2002). The continuous monitoring of the gas phase composition, the IR/Raman spectra of the bonded reagent and the host mineral, as well as the diffractometric pattern of the complex as a function of the temperature offers a unique possibility of precise determination of the complex structure. Identification-discrimination of active inner and outer surface sites of different bonding strengths can contribute to the better understanding of clay-

organic reactions. With accurate mass loss data, the amounts of differently bonded reagents can be determined. The role of water in the formation of the intercalation complex, in the subtle nature of the decomposition process in different environments, as well as in the understanding of the mechanism of partial collapse and re-expansion can be cleared based on the results of the different spectroscopic analyses.

The reactivity of kaolinite can be improved by mechanochemical activation. With the intercalation and the subsequent thermal deintercalation of mechanochemically treated kaolinite superactive centres can be produced. With this method the properties of surface-modified minerals can be tailored to different applications.

### References

- FROST, R. L., KRISTÓF, J., HORVÁTH, E., MARTENS, W. N., KLOPPROGGE, J. T. (2002): *Journal of Colloid and Interface Science*, **251**, 350–359.
- HORVÁTH, E., KRISTÓF, J., FROST, R. L., RÉDEY, Á., VÁGVÖLGYI, V., CSEH, T. (2003): *Journal of Thermal Analysis and Calorimetry*, **71**, 707–714.
- KRISTÓF, J., FROST, R. L., MARTENS, W. N., HORVÁTH, E. (2002): *Langmuir*, **18**, 1244–1249.
- YARIV, S., CROSS, H. (2002): *Organoclay Complexes and Interactions*. Marcel Dekker, N.Y.