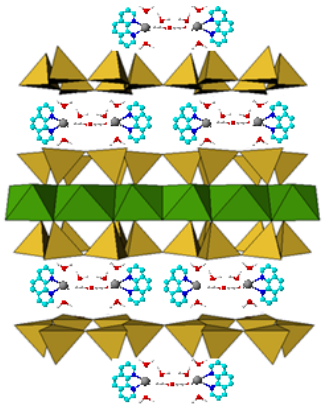
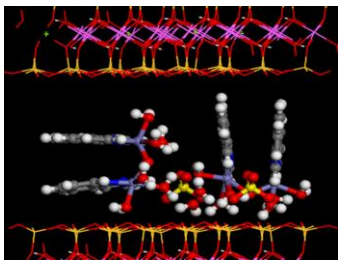
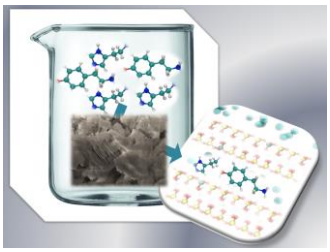
Structure and mineralogy of layer silicates: recent perspectives and new trends

Daniele Malferrari, Fabrizio Bernini







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RESEARCH TOPICS

The research activity is focused to mineralogy and crystallography of layer silicates and their application to material science. The main research topics are:

1) Crystal-chemistry of layer silicates. Understanding the crystal structures of layer silicates is fundamental on predicting the physical and chemical properties of these materials. Past and current works deeply characterized the crystal-chemistry of clay minerals, micas and chlorite, especially those with unusual chemistries and/or atypical physical properties.

2) Pollutants and smelly molecules trapping. The interactions between pollutants and clay minerals at the solid/liquid and solid/gas interfaces represent an important part of environmental mineralogy. Understanding these mechanisms is critical to develop new materials for the remediation not only of polluted media, but also to improve the overall environmental quality, regardless of whether the trapped molecules are hazardous or, simply, smelly.

3) Secondary raw materials recovery and recycling. Recently implemented and developed thanks to the implementation of corporate collaborations and financing of ministerial projects (PRIN 2017). It concerns the development of a low-cost and green method to synthetize tobermorite fully recovering glass and other industrial waste. Tobermorite is a layer-silicate-like mineral with high cation exchange capacity comparable to those of zeolites.

SKILLS

The group have reached a huge experience in the use of the following techniques: i) Single crystal (SC-XRD) and powder X-ray diffraction (XRPD) at ambient and non-ambient conditions; ii) Spectroscopic methods, such as UV-Vis, FTIR, ICP-OES, X-ray absorption spectroscopy (XAS); iii) Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM); iv) Thermogravimetric (TGA), differential (DTA) thermal analyses and evolved gasses mass spectrometry (MS-EGA); v) Chemical methods in general, such as X-ray fluorescence (XRF), elemental analyses (EA), mass spectrometry (ICP-MS).

MAIN COLLABORATIONS

Prof. M.F. Brigatti, DSCG, University of Modena and RE (retired).
Dr. Luca Medici Consiglio Nazionale delle Ricerche - Istituto di Metodologie per l'Analisi Ambientale (Tito Scalo, Potenza).
Prof. Claro Ignacio Sainz-Díaz, Instituto Andaluz de Ciencias de la Tierra (IACT) CSIC, Universidad de Granada.
Dr.ssa Aida Serrano Rubio, Instituto de Ciencia de Materiales de Madrid.
Dr. German Rafael Castro, Spanish Beam Line (SpLine, CRG BM25), ESRF, Grenoble, France.
Dr. Stefano Poppi, CEO of Agrisana s.r.l, Latina.