GEOMATERIALS

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The research groups active on this theme are involved in a series of different projects, in which the contact with industries is on a daily basis. Industries are keen to a better understanding of the thermo-elastic behaviour and phase stability of their starting materials, in order to rationalize their production lines. Better known materials and processes make industrial production cheaper and (possibly) with an inferior environmental impact. This would be the case of using slags (from other industries or from material recycling), as raw materials in green cement and ceramic sanitary-ware production. When the issue of raw material supply is involved, the mining industry is interested in developing and refining strategies and models for discovering new deposits as well as for exploiting the known resources in a profitable and, as prescribed by law, environmental-friendly way.

Research work is three-fold:

- on the raw materials side, industries no more seek for what is available on the market, but instead ask the natural resources experts for raw materials that suit their production needs A multidisciplinary, geo-minero-petro-chemical approach is fundamental for building up reliable minerogenetic models for strategic resources (notably Li, REE, Ni-Cu-Cr-PGE-Au) and for planning ore treatment and waste management;
- on the production side, industries are keen on energy saving (and on lower CO2 emissions to match the Kyoto protocol), so the focus is on the improvement of the processes, with detailed studies of the processes themselves, involving, among others, 3D-computed-tomography of the products and a detailed modelling of the processes involved;
- on the product characterisation side, more and more of the high-performance functional materials are nanocrystalline (or disordered, or amorphous) or micro/mesoporous, making very hard to study the relationship between structure and properties; electron diffraction, total scattering data and modelling are here crucial.

To master all these, the group makes use of the many laboratory instruments present in the Department (2 high resolution powder diffractometers - one with a high temperature chamber at Tmax=1600 °C; 3 single crystal diffractometers, equipped for in-situ high-pressure experiments; a high resolution TEM with a 2Å nominal resolution; a new generation SEM equipped with EDS and a SEM-WDS, both with tungsten-filament emission sources), and also of non-conventional sources, such as synchrotron radiation facilities and neutron sources, together with in-situ trace and isotope analyses (excimer-LAMS).