Exploring the Nanoworld: Electron Diffraction Tomography and Isotopic Analysis for the Characterization of Nanocrystalline Geological, Extraterrestrial and Synthetic Phases

Enrico Mugnaioli, Maurizio Gemelli

2nd year report

Information about results and activities are also available at http://www.nanoworld.unisi.it/.

RU1 – University of Siena

TEM and EDT were used for the characterization of porous materials (pseudo-romanechite and related manganese OMS phases), other advanced synthetic products, impactites from Kamil crater, materials from ultra-thin fault surphaces, nano-crystalline minerals and metamict minerals. Results were published in several international peer-reviewed journals and presented in Italian and international congresses.

PI Enrico Mugnaioli established a collaboration with CNI@NEST (Pisa) for the development of ultra-beam sensitive materials, like zeolites and pharmaceutics.

PI Enrico Mugnaioli was invited in several Italian and foreigner Research Institutions for giving seminars about his activities and results. Several laboratories manifested their interest in developing EDT acquisition facilities.

PI Enrico Mugnaioli was invited to participate as teacher at the international Electron Crystallography School ECS2015 in Poreč. He was charing a session at the XLIV Annual Meeting of the AIC.

RU2 – University of Pisa

A scientific cooperation with the IGG-CNR, Pisa, was signed to formalize the starting of the collaboration. The CNR lab for Isotopic Analysis almost finished the structural and the administrative restructuration and now is ready for the set-up of the main gas lines and the gas-extraction line for the oxygen isotopes analysis. The critical issue for the structural restructuration was the safety requirements for the gas storage. We designed the extraction line following the safety standards and the approved project design advise to put under fume-hood part of the extraction line. A group of meteorites and micro-meteorites, and a batch of standards have been selected for the standardization procedures of the line in order to test the accuracy and precision of the method. In particular, meteorites (HED, Lunar, SNC, OC, CC) and micro-meteorites (I-, G-, V-, P-Type) have been selected for petrographic analysis and sample preparation procedures for the isotopic analysis. The present project triggered and supported a Barringer bursary for the PhD student Agnese Fazio (University of Pisa), dedicated to the investigation of impactites from Kamil Crater, Egypt.
RU2 leader Maurizio Gemelli was invited to give a keynote lecture at the congress Il Pianeta dinamico: sviluppi e prospettive a 100 anni da Wegener, September 2nd-4th 2015, Florence

Activities

Conferences

XLIV Annual Meeting of the AIC, September 14th-18th 2015, Vercelli

Il Pianeta dinamico: sviluppi e prospettive a 100 anni da Wegener, September 2nd-4th 2015, Florence

The 29th European Crystallographic Meeting (ECM), August 23rd-28th 2015, Rovinj (Croatia)

Dissemination

E. Mugnaioli was active in the PhD School “Scienze della Terra, Ambientali e Polari” at the University of Siena.

E. Mugnaioli was invited teacher at the Italy-USA international student exchange Emory School 2015.

E. Mugnaioli was invited teacher at the international Electron Crystallography School ECS2015, Poreč (Croatia).

E. Mugnaioli was invited to give the seminar Automated electron diffraction tomography for ab-initio structure determination of porous materials at the University of Barcelona (Spain).

M. Gemelli is responsible for the course "Laboratorio di Petrografia Regionale" at Earth Sciences Department, University of Pisa.

Formation

E. Mugnaioli participated at the 27th Ad Hoc Workshop on Jana2006: Electron diffraction, Prague (Czech Republic).

Publications


**Main Collaborations**

Johannes Gutenberg University Mainz: development of tomographic electron diffraction systems.

Nanomegas sprl and University of Barcelona: use and development of electron precession.

IIT@NEST: study of Mn-oxide octahedral molecular sieves and development of ultra-fast EDT acquisition routines.

University of Milan Bicocca: study of metamictic minerals.

University of Florence and University of Bari: study of nanocrystalline minerals.

INGV Rome: study of fault surfaces and gauges.

Programma Nazionale delle Ricerche in Antartide (PNRA): study of extra-terrestrial materials

Barringer Family Foundation: study of impactites from Kamil Crater, Egypt.

Independent University of Barcelona: study of rare minerals and application of advanced structure determination routines.

Institute of Chemical Technology (Valencia): study of advanced porous materials.

CNR Institute of Geosciences and Georesources: development of a advanced O-isotope lines