UNIVERSITÀ DEGLI STUDI DI TORINO

TecnArt
Tecnologia e ricerca per l'Arte

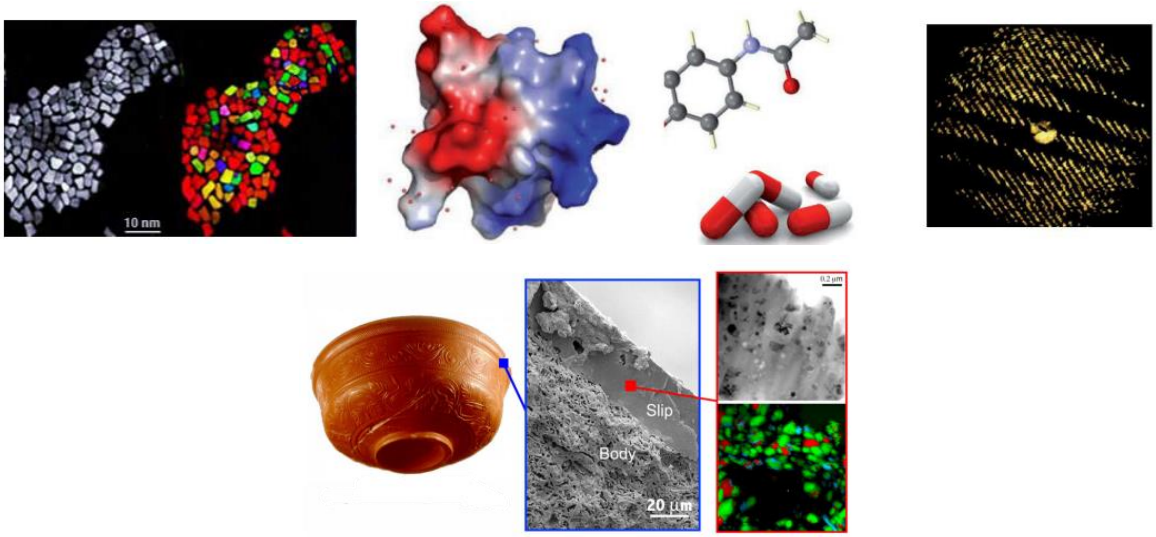
WORKSHOP

Dr. Stavros Nicolopoulos

NanoMEGAS SPRL, Director

Brussels (Belgium)

Advanced TEM electron diffraction studies: from orientation/phase mapping to complex structure determination of nanocrystals



Monday, December 14th 2015

15:00-16:00

Sala Wataghin - Physics Department - Via Pietro Giuria 1, Torino

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Abstract

Transmission Electron Microscopy (TEM) has been greatly developed over the last 30 years by relying on applications focusing mainly on high resolution imaging; in the last decade Cs corrected TEMs made it possible to achieve sub-nanometer resolution. By contrast, TEM applications based on diffraction data did not grow at a similar pace.

In the wake of the pioneering work of Vincent and Midgley in Bristol UK (1994) who developed Precession Electron Diffraction (PED) and the arrival on the commercial market of PED tools (NanoMEGAS, 2004), electron crystallography studies to solve ab-initio unknown structures started to develop rapidly. 3D diffraction tomography and texture imaging of nanocrystals are among the most promising diffraction based developments in TEM.

- 3D Diffraction PED based Tomography (ADT 3D) technique (Kolb et al), permitted in the last few years (2010-15), to solve more than 200 previously unknown structures from crystals of nm size (25-500 nm , from complex zeolites and minerals to metals, alloys and ceramics), including very recent work on protein structures (JP Abrahams et al, Nanenga et al).

- Another key PED-based application in TEM, is the ASTAR technique that makes possible to obtain orientation and phase mappings at 1 nm resolution for a variety of materials (metals, alloys, ceramics, semiconductors, oxides etc.). This technique allows to have a deep insight into the texture of the material (like EBSD in SEM but at nm scale) for example it helped research into the human bone bio-mineralization by revealing bone texture at nm scale. Orientation imaging can be combined with PDF (pair distribution analysis) of amorphous phases to identify compounds and the extent of crystallization in complex systems by using TEM diffraction techniques.

As a result of all those PED related tool developments, effective use of novel electron diffraction applications can turn any TEM (100-300 kv) into a very powerful analytical probe, complementary to Synchrotron facilities.

The speaker

Dr. Stavros Nicolopoulos holds a B.S. in Physics (University of Thessaloniki, Greece) and a PhD in Materials Science (University of Grenoble, France). He worked as Associate Professor at Complutense University (Madrid, Spain) from 1991-96 dedicated to biomaterials research at the School of Pharmacy. He worked from 1996 to 2004 in Philips Electron Optics as TEM application specialist and from 2001 as President of FEI (former Philips Electron Optics) in Spain. He is President and co-founder of the NanoMEGAS SPRL company based in Brussels, the first company in TEM microscopy field that commercialized innovative precession electron diffraction devices/applications worldwide. He leads NanoMEGAS SPRL Company with 13 other scientists and technical collaborators. Precession electron devices in electron microscopes (TEM) first developed and commercialized by NanoMEGAS in 2004 were critical to allow solving nm size crystal structures using PED devices, rendering the technique as complementary to Synchrotron X-Ray powder diffraction applications.

He is author/co-author of more than 60 international peer-reviewed journal publications, 42 congress proceedings publications, and participated in 52 invited lectures and has participated in/co-organized 35 international electron microscopy/crystallography workshops worldwide since 1998.