Department of Metallurgical and Materials Engineering, IIT Madras
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Electron Microscopy Society of India

Cordially invites you for a talk on

ASTAR: an efficient tool for TEM characterization

By
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Date: December 23, 2015; Time: 11.30 AM (Tea at 11.15 AM); Venue: MSB 104

About the Topic

ASTAR is a TEM attachment that couples beam scanning with electron precession in order to provide orientation and phase mapping of TEM specimens. The process consists of (i) acquiring the processed electron diffraction (PED) patterns at every location of the scanned area and (ii) analysing the patterns with a dedicated template matching technique**.** On FEG equipped transmission electron microscope, orientation and phase maps are reconstructed with a spatial resolution of 1 nm for regions of interest of up to 100 μm^2.

The present work will describe the method and illustrate the potential of the technique in various fields of research with results concerning metallurgy, microelectronics, geology but also biology and pharmacy. As PED patterns are systematically stored during the acquisition, numerous post processing strategies may be considered to complement the material characterization. The most promising developments will be introduced. In particular the huge potential of virtual bright- and dark-field images reconstruction will be commented. Also, the recent correlation coefficient map construction technique that highlights the inner grain or phase boundaries will be described.

About the Speaker

Prof. Muriel Veron is a Professor in Metal Physics Group at Grenoble, France, Deputy Director of Phelma and nominated at the French University Vouncil Research Lab. She did her post doc. At McMaster University with Prof. Embury after completing her Ph.D., on directional coarsening during creep of single crystal Ni base superalloys at CNRI France. She has guided 13 students with around 50 publications. She has received the coveted award of Ugine Rene Castro – 2011 for outstanding work in metallurgy. She is instrumental in launching a new field in TEM, the Orientation imaging microscopy at nm level and has developed ASTAR the methodology for doing the same.

ASTAR: an efficient tool for TEM characterization

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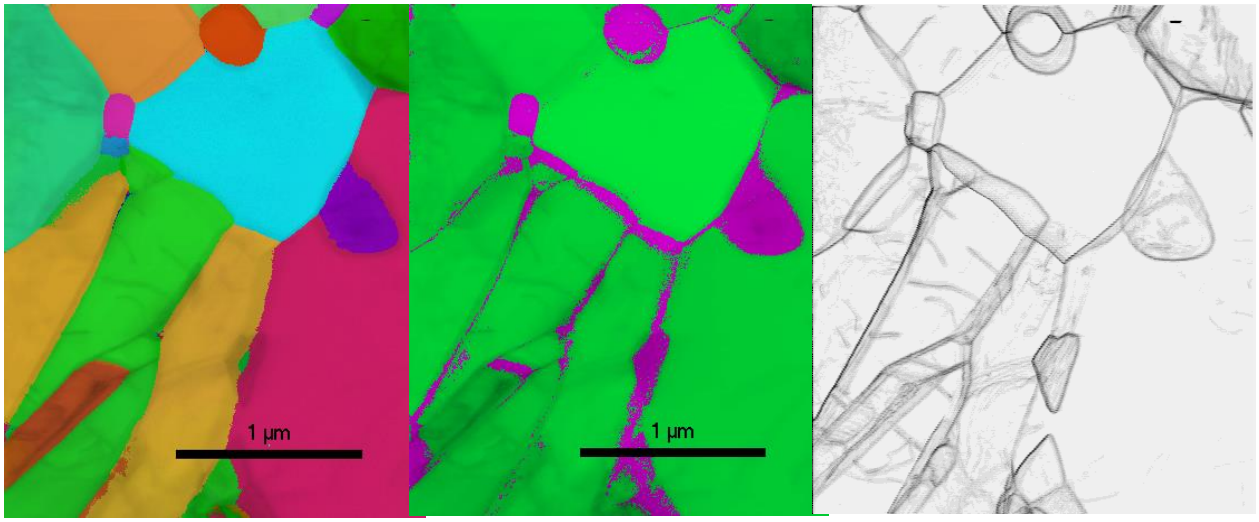
ASTAR is a TEM attachment that couples beam scanning with electron precession in order to provide orientation and phase mapping of TEM specimens (fig 1.a and b). The process consists in (i) acquiring the precessed electron diffraction (PED) patterns at every location of the scanned area and (ii) analysing the patterns with a dedicated template matching technique [1]**.** On FEG (respectively LaB6) equipped transmission electron microscope, orientation and phase maps are reconstructed with a spatial resolution of 1 nm (resp. 10nm) for regions of interest of up to 100 µm^2 (resp. 300µm^2).

The present work will describe the method and illustrate the potential of the technique in various fields of research with results concerning metallurgy, microelectronics, geology but also biology and pharmacy.

As PED patterns are systematically stored during the acquisition, numerous post processing strategies may be considered to complement the material characterization. The most promising developments will be introduced. In particular the huge potential of virtual bright- and dark-field images reconstruction [2] will be commented. Also, the recent correlation coefficient map construction technique that highlights the inner grain or phase boundaries will be described (fig. 1.c) [3].



(a) Orientation map combined (colours) to virtual brightfield image (greyscale)

(b) Phase map (colours) to virtual brightfield image (greyscale)

(c) Correlation coefficient map highlignting grain and phase boundaries.

Figure 1: Study of Titanium alloy (courtesy J. Westraadt [3])

Reference:

[1] E. Rauch, M. Véron, J. Portillo, D. Bultreys, Y. Maniette, and S. Nicolopoulos, *Microscopy and Analysis*, Issue 93, pp. S5-S8, November (2008).
[2] E. Rauch and M. Véron, Eur. Phys.Appl. Phys., 66: 10701 (2014)
[3] J. Westraadt, private communication