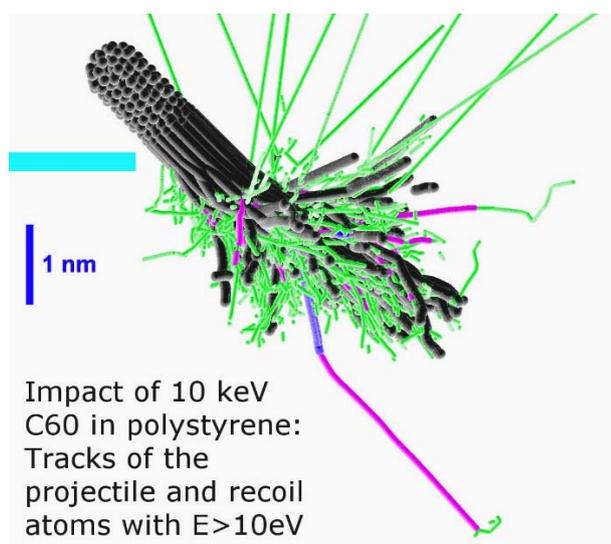


“SIMS: Understanding the impact”

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The lecture will explore the microcosm of processes taking place during the few picoseconds of an impact in secondary ion mass spectrometry, with an emphasis on the effects induced by cluster ion beams, which are now the leading projectiles in SIMS (Au_3^+ , Bi_n^+ , C_{60}^+ , Ar_n^+). The “new” physics encountered with these polyatomic projectiles significantly differs from that described in textbooks for atomic primary ions (classical sputtering/cascade theory) and those important differences will be pointed out. The presentation will essentially rely on the results of computer simulations for the description of sputtering and on experimental studies aimed at elucidating ion emission in SIMS [1-4]. In particular, sputtering will be illustrated with movies of the dynamics and a practical demonstration of the Monte Carlo code SRIM. The connection with the everyday experience of the SIMS analysts will be highlighted.



Topics:

- Impact (where does the energy go? do clusters implant? backscatter? why do craters form? do they create topography? clusters vs. atoms: what are the consequences?)
- Damage (what controls it? how to reduce it?)
- Emission (why do I see fragments, intact molecules, clusters? how do they depend on projectile size, energy, angle?)
- Ionization (what do we know: physical vs. chemical effects?)
- Matrix and substrate effects (on sputtering? on ionization?)
- Information depth (in the end: are clusters more

or less surface-sensitive than atoms?)

Requirements: Attendees are invited to install SRIM on their laptops if they want to try it on their own (<http://www.srim.org/>).

Literature:

- [1] B. J. Garrison, Z. Postawa, *Computational view of surface based organic mass spectrometry*, *Mass Spectrom. Rev.*, 2008, 27, 289-315.
- [2] Chapters 3-6 in *ToF-SIMS: Materials Analysis by Mass Spectrometry* (2nd Edition), J. Vickerman and D. Briggs (Eds); IM Publications, Chichester, 2013. pp 87-123.
- [3] A. Delcorte, O. A. Restrepo, B. Czerwinski, *Cluster SIMS of organic materials: Theoretical Insights*, Chapter 2 in *Cluster Secondary Ion Mass Spectrometry: Principles and Applications* (First Edition), Ch. M. Mahoney (Ed), John Wiley & Sons, Inc. 2013. pp 13-55.
- [4] T. Aoki, *Molecular dynamics simulations of cluster impacts on solid targets: implantation, surface modification, and sputtering*, *J Comput. Electron.* 2014, 13, 108–121