Numerical modeling of field ejection assisted by ultra-short laser pulses: Pushing the atom probe tomography to its highest capacities

Modélisation numérique de l'éjection par effet de champ assistée par impulsions laser ultra-brèves : pousser la sonde atomique tomographique au-delà de ses extrêmes limites

The reduction of microelectronic systems requires the development of new characterization tools and methodologies. This is in fact a major challenger for modern nanosciences and nanotechnologies. *In-situ characterization techniques* that allow one to follow real time phase formations, stability and degradation, during both deposition process and post-deposition heat treatment are essential for the understanding of the fundamental mechanisms governing these phenomena. These techniques have to be combined with advanced characterization methods with very high spatial resolution that are able to analyze the redistribution at the nanoscale. *The tomographic atom probe* is such an instrument that allows performing analytical imaging of materials *in three dimensions at the atomic scale.* Femtosecond pulses with relatively small intensities (close to the ablation threshold) result in a smoother surface treatment than picoseconds laser pulses. For these reasons, the project partners have chosen femtosecond lasers for the laser assisted *atom probe* tomography (La-APT). To increase the performances of the femtosecond laser assisted APT, it is important to study the tip-laser interaction in order to understand the atomic ejection mechanisms.
The interaction of a femtosecond pulse with a sub-wavelength tip, under the effect of a standing electric field, and its ejection are in the focus of this project that will be conducted in collaboration between the Hubert Curien Laboratory (Saint-Etienne, Jean Monnet University, http://abh-curien.univ-st-etienne.fr) and GPM group (The University of Rouen, www.univ-rouen.fr/gpm/).

Post-doctoral position (starting from 2010)

The candidate will develop models of femtosecond interactions with a small (hundreds of nanometers) object in the form of tip placed in a strong external field. The tip material can be metal, semiconductor and/or dielectric. The modeling will be aimed at the prediction programs to interpret the experimentally obtained results, such as time-of-flight spectra and ATP results.
The successful candidate can be specialized in physics with particular knowledge in laser-matter interactions, non-linear optics, and/or quantum chemistry and computer simulation methods. Previous experience in numerical modeling using molecular dynamics, ab-initio, hydrodynamics or similar methods will be highly appreciated.

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