ATOMIC FORCE MICROSCOPY (AFM) APPLICATION TO DIATOM STUDIES: REVIEW AND PERSPECTIVES

Ana Teresa Luís[1], Daša Hlúbiková[1], Patrick Choquet[2], Véronique Vaché[3], Lucien Hoffmann[1] & Luc Ector[1]

[1]Public Research Centre - Gabriel Lippmann, Department of Environment and Agro-biotechnologies (EVA)

[2]Public Research Centre - Gabriel Lippmann, Department of Science and Analysis of Materials (SAM)

[3]Novelis, Foil Innovation Centre

Scanning Probe Microscopy (SPM) is a type of microscopy that produces images of surfaces using a physical probe that scans the object. One of the noteworthy types of SPM discovered in 1986 is Atomic Force Microscopy (AFM), which can image both conductive and non-conductive samples and is currently applied in various environments (air, liquid and vacuum) and types of materials (soft samples such as polymers and biological samples and hard surfaces of inert materials). Three modes of AFM were reviewed in this work: contact, non-contact and tapping modes, but the tapping mode was highlighted as the best for biological samples, because it enables the topography of soft and adhesive trails to be imaged in their natural hydrated state.

Diatoms, unicellular microalgae that make a composite cell wall of silica and organic material, are a group of organisms that offer great opportunities for AFM studies. These algae are recognized as useful model organisms to understand biomineralization. Thus application of AFM to the study of diatoms is good to 1) study biosilica formation, 2) the ultrastructural characterization of the diatom frustule, 3) to determine the micromechanical properties of the frustule and 4) the characterization of the extracellular polymeric substances (EPS) of the frustule and their adhesion properties. All of these observations can be made at a resolution scaled in nanometers. In the present study, previous work on these 4 topics has been reviewed. From a taxonomical point of view, new data about *Amphipleura pellucida* Kützing is presented, showing topographical images of diatom frustules, putting in evidence the small pores of this taxon. They are at the limit of the light microscope's resolution. These AFM images enable the comparison of pore size and height, as well as pore-to-pore distances. Thus, without the need of sample coating, AFM allows detecting small differences in surface morphology providing new insights into diatom taxonomy and future applied technologies.