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UV and THz assisted APT analysis of a silica matrix for **bio-particles embedding**

Matteo DE TULLIO^{1*}, Ivan BLUM¹, Emmanuel CADEL¹, Laurence CHEVALIER¹, Gustav ERIKSSON², Martin ANDERSSON², Jonathan HOUARD¹, Marc ROPITAUX³, Angela VELLA^{1*}.

¹ GPM Laboratory, CNRS UMR 6634, Rouen University, Normandy, France.

² Department of Chemistry and Chemical Engineering - Chalmers University of Technology, Gothenburg 41296, Sweden. ³ Glyco-MEV Laboratory – UR 4358, Université de Rouen Normandie, Rue Lucien Tesnière, Mont-Saint-Aignan, France.

Abstract

Unravelling the 3D structure and composition of biological macromolecules at nanoscale sheds light on their functions. In such a context, Atom Probe Tomography (APT) is lately arousing interest because it provides a three-dimensional compositional mapping with sub-nanometric resolution, adding high chemical sensitivity throughout the whole periodic table of elements [1]. Recently, it has been shown that biomolecules can be embedded in dielectric materials, such as silica, and analyzed by the laser-assisted APT (La-APT), by combining the actions of a high DC field and an ultrashort laser pulse [2]. In this work, we focus on the APT analysis of amorphous silica matrices embedding ferritin proteins, synthesized via a water glass sol-gel process, with the aim to recreate a viable environment for biomolecules [3]. Three different APT analyses are compared, differing for laser illumination configurations: a La-APT shining UV radiation (LAWATAP) and a Terahertz-assisted APT (Tera-**SAT**), providing a mono-cycle THz high field.



* matteo.de-tullio@univ-rouen.fr * angela.vella@univ-rouen.fr

described. Dominant amino-acid traces (CNH₂+, CO₂+), are recognizable in IgG mass spectrum (a) and are spatially the core of ferritin (d), an iron-storing protein. ^{54,56}Fe²⁺ is densely located at reconstructed by generating an iso-density region with a specific filtering criterion (b). Bright field transmission electron • the inner core, P⁺ in both the inner core and core/shell interface and iron microscopy (TEM) confirms "Y-shaped" IgG monomers were encapsulated inside the silica matrix (c). • oxides are mostly distributed at the core/shell interface (e).



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