# Biointerface's Characterization by IR Spectromicroscopy: Widening the Frontiers of IR Analysis to Bio-Inspired Hierarchical Materials

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In recent decades, the development of new IR technologies has greatly expanded the scale of attainable spatial resolution, from the macro-scale to the nano-scale, crossing the micrometric and sub-micrometric domains. Full accessing the hierarchic chemical organization of matter is therefore nowadays possible, exploiting the better match between morpho-characterization tools, such as TEM, SEM and AFM, and IR analysis, and paves the way for innovative solutions in life and material science.

The present lesson focuses on the multi-technique and multi-scale characterization of bio-inspired hierarchical materials with application in fields ranging from biocatalysis to tissue-engineering, considering also material's toxicity.

It will be presented the first example of rational development of immobilization protocols relying on direct observation of the ω-transaminase enzyme conformation upon immobilization on commercially controlled porosity glass carriers (EziG™) by FTIR spectromicroscopy[1]. The second case study will focus on Silkothane®, a recently developed bio-hybrid material for vascular tissue engineering applications, obtained in the form of nanofibrous matrices via electrospinning of a silk fibroin (SF) and polyurethane (PU), both individually and as a blend. SF-PU meshes were studied by means of a combination of scanning electron microscopy, micro-ATR imaging and IR s-SNOM[2]. Finally, two studies of biomolecular adsorption on exogenous materials will be introduced: i- the nanoresolved infrared spectroscopic evidence of DNA immobilization and structural modification on halloysite nanotubes, promising candidates as gene nanocarriers [3]; ii- new findings on the peculiar behavior of holoferritin with respect to its apo-form upon adsorption onto asbestos fibers, providing new clues on the mechanisms responsible of the toxicity of the material.

## References

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