

NIR-emitting nanoparticles provide implants new functionalities

Daniel Jaque[#]

Nanomaterials for BioImaging Group, Departamento de Física de Materiales, Facultad de Ciencias,
Universidad Autónoma de Madrid, Madrid, SPAIN

Cardiovascular stents have revolutionized the treatment of coronary artery disease, yet once implanted they remain passive devices that provide no direct information about the biochemical state of the surrounding arterial tissue. As a consequence, the monitoring of plaque progression or implant performance still relies on indirect and often invasive imaging techniques. Developing implants capable of reporting molecular information from within the artery therefore represents an important unmet clinical challenge.

In this talk, I will present our recent efforts toward the development of light-enabled cardiovascular implants based on clinically used stents functionalized with near-infrared (NIR-II) emitting Ag₂S nanoparticles. These luminescent nanostructures transform conventional stents into active optical devices capable of generating infrared signals that can be detected through biological tissue. I will discuss the design of the nanomaterials, their integration onto clinical-grade stents, and the optical principles that allow the implanted device to act as a nanoscale light source within the artery. I will also introduce a recently developed sensing strategy based on tissue-induced spectral distortions, in which wavelength-dependent changes in the broadband emission of the nanoparticles provide information about the biochemical composition of the surrounding arterial environment. Finally, I will illustrate how this approach may enable fluorescence-based visualization of stent implantation and discuss its potential for future non-invasive monitoring of lipid-rich atherosclerotic plaques and implant status.

daniel.jaque@uam.es