Lorenzo Albertazzi

Title
“Understanding nanomedicine one molecule at the time”

Abstract
Nanomaterials revolutionized the field of biomedicine introducing innovative approaches towards drug delivery, molecular imaging, regenerative medicine and biosensing. Understanding nano materials structure, functionality and behavior in the biological environment is crucial towards the rational design of effective materials. Here we will present the use of advanced microscopy techniques to visualize biomaterials with nanometer resolution and single-molecule sensitivity both in vitro and in cells. I will discuss three main topics at the intersection of nanomedicine and imaging: i) the use of super-resolution microscopy as a new material characterization tool, ii) the use of single-molecule microscopy to study cell biomarkers in the context of personalized medicine and iii) how HT imaging of cell-materials interactions can be used to the rapid design of new materials.

Short Bio
Lorenzo Albertazzi is an associate professor at the TU/e department of Biomedical Engineering leading the research group Nanoscopy for Nanomedicine. For most of his career he has been jumping between Chemistry and Biophysics; in his research he now aims to combine both to achieve a molecular understanding of synthetic materials in the biological environment, using optical microscopy and nanoscopy. He obtained a MSc in Chemistry (2007) and a PhD in Biophysics (2011) from Scuola Normale Superiore (Pisa, Italy). He then joined Eindhoven University of Technology (TU/e, The Netherlands) as postdoctoral and NWO VENI fellow. In 2015, he moved to Barcelona (Spain) to the Institute of Bioengineering of Catalonia (IBEC) to start the 'Nanoscopy for Nanomedicine' group that he currently leads. In 2018 he was appointed Associate Professor at the TU/e department of Biomedical Engineering.

Filippo Rossi

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POLYMER PHASE SEPARATION AS ADDED VALUE IN CONTROLLED DRUG DELIVERY SYSTEMS

Abstract

When two different liquid-phase materials are mixed, the mixed fluid behaves as either completely miscible or separated in distinct two phases, called phase separation. As for organic materials, phase separation of two liquid-phase polymers has been extensively investigated for block copolymers, liquid crystal and biopolymer mixtures that occur due to reciprocally low affinity of each liquid material. Meanwhile, although two liquid-phase polymers are initially miscible, the phase separation of these materials occurs when one of the material transits from liquid to solid, such as polymerization-induced phase separation (PIPS) that forms wide morphological varieties of precipitated structures from nanometer to sub-micrometer scales. However, a challenging question remains whether entire solidification of liquid-phase multiple polymer mixture can induce macroscopic phase separation, because the phase separation dynamics is strongly hindered by the crosslinking when both materials transit from liquid to solid. Similar macroscopic phase-separation in entire solidification is known to occur in metal alloys or ice when tap water is frozen in a freezer, crystallization of water molecules starts on the surface of the water, causing that impurities in the water are condensed into the center of the ice. Nevertheless, few studies so far have reported the phase separation driven by the entire solidification of two miscible polymeric organic solutions. This phenomenon opens the possibility to many novel drug delivery devices, here the focus is on gels [1,2] and bijels [3,4], that can represent promising possibilities as controlled drug delivery systems.

Bibliography :
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[2] Bernasconi R. et al. Mater. Des. 2021, 197, 109212
[3] Pizzetti F. et al. Adv. Mater. Interfaces 2021, 8, 2100991
[4] Pizzetti F. et al. Gels 2024, 10, 72.

Short CV

Filippo Rossi received his MSc and then PhD in chemical engineering from Politecnico di Milano in 2007 and 2011 respectively. Then he spent research periods at Uppsala University, Mario Negri Institute for Pharmacological Research, Keio University and now he is Associate Professor at Politecnico di Milano. His research interests are focused on developing novel technologies to solve problems associated with health and the environment using functionalized polymers in bulk and colloidal forms.