Functional imaging with luminescence

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Fluorescence imaging is well known as a facile, relatively cheap, fast and sensitive set of techniques to explore a variety of samples, from the biological field to material science, soft matter and engineering.

To gain insightful information on such diverse samples we need to combine (i) tailored imaging methods with (ii) suitable luminescent probes.

Such combination, when well adapted to the material under study, can yield *quantitative* information from microscopy data and allow to map – in time and space – a number of physical and chemical properties of high relevance to understand processes, mechanisms and properties of the systems under investigation. Compiling this kind of maps, that – just as geographic ones – carry plenty of useful information, is named *functional imaging*.

This contribution will introduce the audience to tailored luminescence mapping techniques and novel luminogenic probes that we have designed and developed for different applications, from environmental analysis (rapid and sensitive detection of nanoplastics)[1] to nanomedicine (monitoring protein aggregation),[2] to polymer science and technology (mapping local mobility) and to smart autodiagnostic materials (mapping stress accumulation).[3]

[1] M. Cingolani, E. Rampazzo, N. Zaccheroni, D. Genovese, and L. Prodi, “Fluorogenic hyaluronan nanogels for detection of micro- and nanoplastics in water,” *Environ Sci Nano*, vol. 9, no. 2, pp. 582–588, 2022, doi: 10.1039/d1en00684c.

[2] M. Cingolani, F. Lugli, M. Zaffagnini, and D. Genovese, “Fluorogenic Hyaluronan Nanogels Track Individual Early Protein Aggregates Originated under Oxidative Stress,” *ACS Appl Mater Interfaces*, vol. 16, no. 3, pp. 3056–3063, Jan. 2024, doi: 10.1021/acsami.3c13202.

[3] M. Raisch *et al.*, “Highly Sensitive, Anisotropic, and Reversible Stress/Strain-Sensors from Mechanochromic Nanofiber Composites,” *Advanced Materials*, vol. 30, no. 39, 2018, doi: 10.1002/adma.201802813.