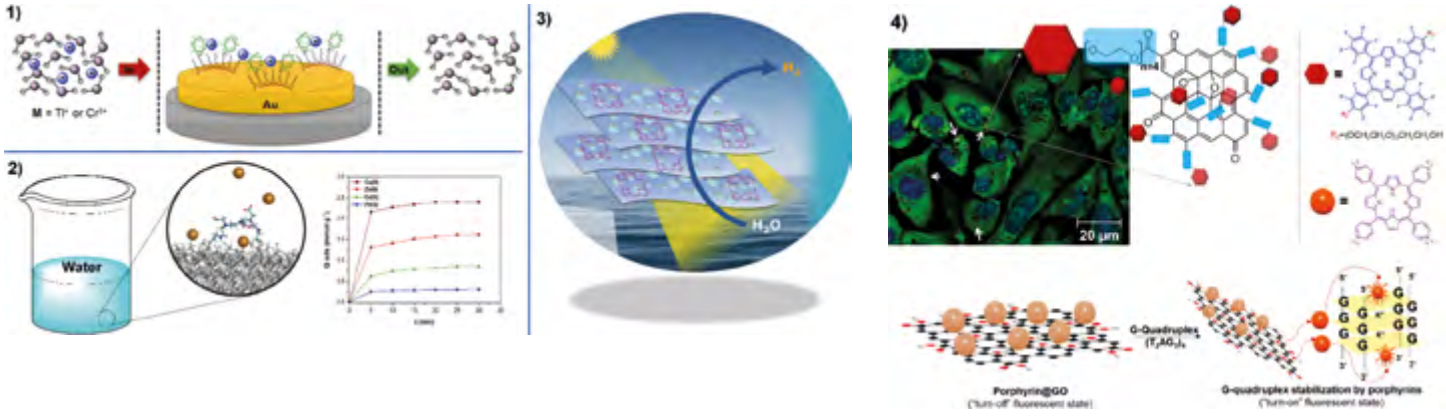
The Design of functional hybrids for enviromental and biological applications

N. M. M. Moura[1], C. I. V. Ramos[1], Ana R. Monteiro[1], Carla I.M.Santos[1], M. Amparo F. Faustino[1], Sara R. D. Gamelas[1], Ana T. P. C. Gomes[1], M. Graça P. M. S. Neves[1], André P. Carvalho[2], Sérgio M. Santos[2], Sara Fateixa[2], Tiago Fernandes[2], Ana L. Daniel-da-Silva[2], Tito Trindade[2], Marta I. S. Veríssimo[3], M. Teresa S. R. Gomes[3], Gil Goncalves[4], Paula A. A. P. Marques[4]

1 — Department of Chemistry & QOPNA, University of Aveiro
2 — Department of Chemistry & CICECO, University of Aveiro
3 — Department of Chemistry & CESAM, University of Aveiro
4 — Department Mechanical Engineering & TEMA, University of Aveiro

FIGURE 1
Mold cavity containing the SMPU with the embedded FBG and evolution of the Bragg wavelength along with the injection time.

The design of materials with appropriate features for a special application is meriting high interest between the scientific communities. Under this context novel materials decorated with organic compounds were developed for environmental and biomedical applications. The new materials demonstrated a synergic effect between the properties of the organic counterpart and the solid support selected and high potential to act as 1) adsorbent for metal cations removal from water; 2) metal cations detection; 3) photocatalyst for H_2 production from water, and 4) antitumor drug, detecting and stabilizing DNA G-quadruplexes. Knowing that the effects associated to overpopulation and pollution is putting in risk WATER and among the pollutants heavy metals merit a special attention, we found that piezoelectric quartz crystal gold electrodes coated with a *N*-confused porphyrin immobilized on silica or Merrifield resin respond to Tl^{+} and Cr^{3+}, showing an higher sensitivity to Cr^{3+} [1]. The immobilization of amino penta-carboxylic acid on silica also afforded a highly chelating and stable hybrid adsorbent for Cu^{2+}, Zn^{2+}, Cd^{2+} and Pb^{2+} and its application for metals extraction from natural waters was reliable [2]. Another promising research is related with the development of photocatalysts based on graphitic carbon nitride (g-C_3N_4) to generate H2 from water splitting. The works developed demonstrated that the sensitization of g-C_3N_4 with porphyrins or holey g-C_3N_4 doped with carbon enhances the photocatalytic H_2 evolution under visible light irradiation, making them potential materials for solar conversion to produce H2 from water [3,4]. Our expertise led us to develop nanoplatforms containing porphyrins and graphene oxide (GO) to promote the selective detection and stabilization of DNA guanine-quadruplex (G-Q) structures, paving the way for a new class of antitumor drugs, based on the inhibition of telomerase. New hybrids biocompatible with human Saos-2 cells were also prepared based on porphyrins with glycol branches covalently attached to GO nano-sheets; the results are very promising for future application namely in cancer therapy.



References
[1] Molecules, 2018, 23(4), 867. [2] J. Mater. Chem. A, 2018, 6, 13096–13109; [3] Applied Catalysis B: Environmental, 2018, 221, 56–69; [4] ChemSusChem, 2018, 11, 2681-2694; [5] ACS Omega, 2018, 3, 11184-11191; [5] CARBON, 2018, 135, 202-214.