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## Development of stimuli-responsive graphene-based yolk-shell magnetic nanoparticles for controlled release of anticancer drugs

**Raquel O. Rodrigues<sup>1,2</sup>, Giovanni Baldi<sup>3</sup>, Saer Doumett<sup>3</sup>,  
Manuel Bañobre-López<sup>4</sup>, Juan Gallo<sup>4</sup>, Goran Dražić<sup>5</sup>, Rui Lima<sup>6</sup>,  
Adrián M. T. Silva<sup>2</sup>, Helder T. Gomes<sup>1,\*</sup>**

<sup>1</sup>Associate Laboratory LSRE-LCM, Polytechnic Institute of Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

<sup>2</sup>Associate Laboratory LSRE-LCM, Faculdade de Engenharia, Universidade do Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal

<sup>3</sup>CERICOL, Centro Ricerche Colorobbia, Via Pietramarina 123, 50053 Sovigliana – Vinci, Firenze, Italy

<sup>4</sup>Advanced (magnetic) Theranostic Nanostructures Lab, INL – International Iberian Nanotechnology Laboratory, Av. Mestre José Veiga, 4715-330 Braga, Portugal

<sup>5</sup>Laboratory for Materials Chemistry, National Institute of Chemistry, Hajdrihova 19, SI-1001 Ljubljana, Slovenia

<sup>6</sup>University of Minho, Mechanical Engineering Department, Campus de Azurém, 4800-058 Guimarães, Portugal

\**htgomes@ipb.pt*

Magnetic drug delivery systems have attracted much attention in the last decades due to the possibility to improve the therapeutic efficacy of anticancer drugs, by enabling instable and poorly soluble drug agents to reach tumour cells after being guided by low magnetic fields and monitored by magnetic resonance imaging (MRI) [1]. Hence, a lower amount of anticancer drug is needed and the typical side effects of chemotherapy are minimized [2]. Commonly, these nanoparticles are designed with a magnetic core coated with a metal or a non-metal structure, such as gold or silica. However, these approaches present some drawbacks, such as low drug loading capacity and lack of stimuli-responsive release. Alternatively, carbon-coated magnetic nanoparticles offer higher chemical and thermal stability, larger surface area, biocompatibility and easier functionalization due to the high capacity of adsorption. Moreover, these materials have shown great ability to be used as pH stimuli-responsive controlled release platforms, due to the disruption of supramolecular  $\pi$ - $\pi$  interaction at acidic pH [3]. In this context, graphene-coated yolk-shell magnetic nanoparticles – hybrid materials comprising a superparamagnetic core coated by a graphene-based shell that covers a hollow region (i.e.,  $\text{Fe}_3\text{O}_4$ @void@C), – were developed as super-drug nanocarriers systems, exhibiting high loading contents of the anticancer drug Doxorubicin due to the large cavity volume between the shell and the magnetic core, and a stimuli-responsive controlled release in response to acidic environments (pH 5), such as those found in tumour tissues. These results shed light on the development of new hybrid nanomaterials with high potential to be applied in biomedical applications.

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