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Hybrid core-shell gold nanoshell/silica nanomaterials for nanomedecine

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In nanomedecine, gold nanoshells are ones of the most popular nanoparticles used for cancer phototherapy. Due to the so-called Surface Plasmon Resonance (SPR) phenomenon, gold nanoshells exhibit upon light irradiation localized photothermal features that allow destruction of cancer cells by hyperthermia. Moreover, by adjusting the shape and size of nanoparticles, irradiation can be done in the near infrared region (NIR) where human tissues are the most transparent to light (biological window). However, using gold nanoshells in the design of hybrid organic-inorganic nanomaterials is still little-explored in literature. In this context, we develop and will show a novel multifunctional hybrid core-shell nanomaterial based on a gold nanoshell/silica nanoporous structure. The main advantage is to combine drug delivery and photothermal features in one single entity. Organic nanovalves as pore gate-keepers grafted within the silica shell have been used to insure a control of the drug delivery from the mesoporous structure upon local heating of nanoshells submitted to NIR laser irradiation. Synthesis of materials is performed through a sol-gel approach including structuring agents providing mesoporous silica shell structure with a radial pore orientation. Different morphological and physico-chemical parameters (shell thickness, grafting density of nanovalves…) were modified as well as laser irradiation conditions to adjust and control the drug delivery efficiency. The structure, shape and morphology were characterized among all techniques by Transmission Electron Microscopy, Scanning Electron Microscopy and Nitrogen adsorption while chemical order was analyzed via X-ray photoelectron (XPS) and Auger spectroscopies. The therapeutic properties of core-shell nanomaterials were finally evaluated through *in vitro* experiments on cancer ovarian cells.

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