Electronic Supplementary Information

Synthesis of mesoporous-silica-coated Gd_2O_3:Eu@silica particles as cell imaging and drug delivery agents

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The FT-IR spectrum provides the insight into the chemical composition of the as-prepared sample (Figure S1). A broad absorption band peaking at 3400 cm^{-1} and a shoulder located at 1645 cm^{-1} are the characteristic absorption of water of hydration in the structure or surface adsorbed water and hydroxyl groups (OH^-).[1] The presence of carbonate anions in the molecular structure was confirmed by the appearance of absorption doublets in the region 1350–1600 cm^{-1} (ν_3 of CO_3^{2-}, peaking at ~1408 and 1504 cm^{-1}) and also by the occurrence of multiple absorptions ranging from 500 to 1000 cm^{-1} (ν_2 and ν_4 of CO_3^{2-}).[2,3] The elemental analysis quantifies the elemental components (mass %) of the as-prepared precursor. Elemental contents of the dried particles analyzed by the inductively coupled plasma (ICP) spectrophotometric method were listed in Table S1, yielding a (Gd+Eu):C:O molar ratio of about 1:1.01:5.10. Assuming that all the carbon was from CO_3^{2-} and considering molecular neutrality, the chemical formula of the as-prepared product may be expressed as $Gd(OH)CO_3 \cdot H_2O$. The results are consistent with the pioneering work of Matijevic *et al.* and the work by Lechevallier's group.[4]

The thermogravimetric analysis (TGA) curve of the as-prepared sample was shown in Figure S2. The weight loss of $Gd(OH)CO_3 \cdot H_2O$:Eu undergoes a three-step process. The first one (25-170°C) is due to the desorption of water molecules adsorbed at the particles surface due to the storage in air. The second weight loss (170-550°C) is related to the removal of water molecules due to the dehydration of hydrated compounds and the self-condensation of hydroxyl groups (O-H). The third one (550-750 °C) originates from the release of CO_2 molecules.[4]

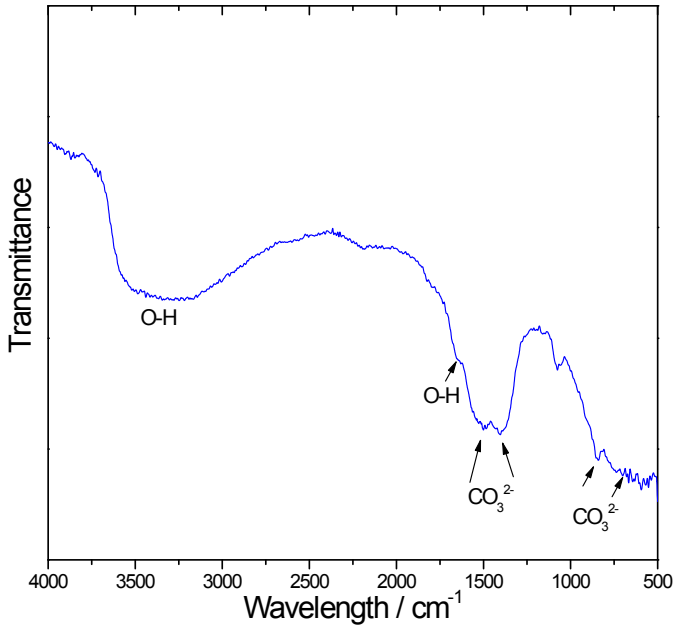

Figure S1. FT-IR spectra of the as-prepared $Gd(OH)CO_3 \cdot H_2O$:Eu (a) and the samples calcinated at 550 ºC (b) and 750 ºC (c), respectively.

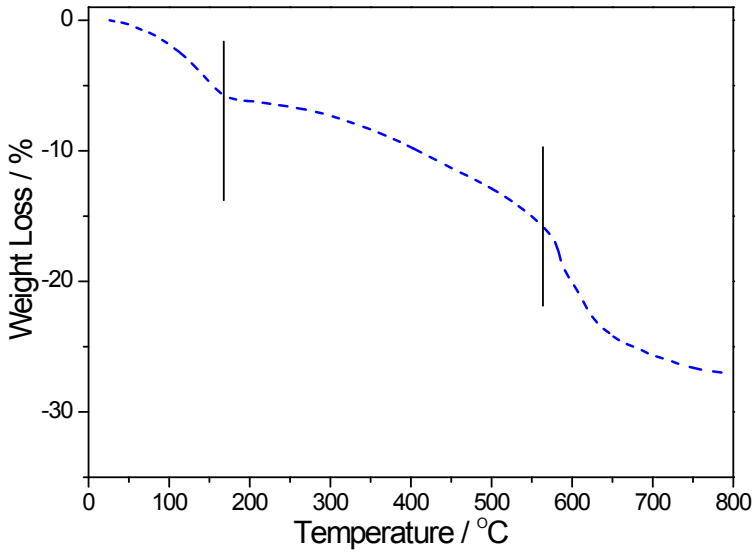

Figure S2. Thermogravimetric analysis curve of the precursor $Gd(OH)CO_3 \cdot H_2O$:Eu measured in air.

Table S1. Elemental content of as-prepared particles (mass %).

Gd	Eu	C	O
58.2%	3.7%	4.8%	31.6%

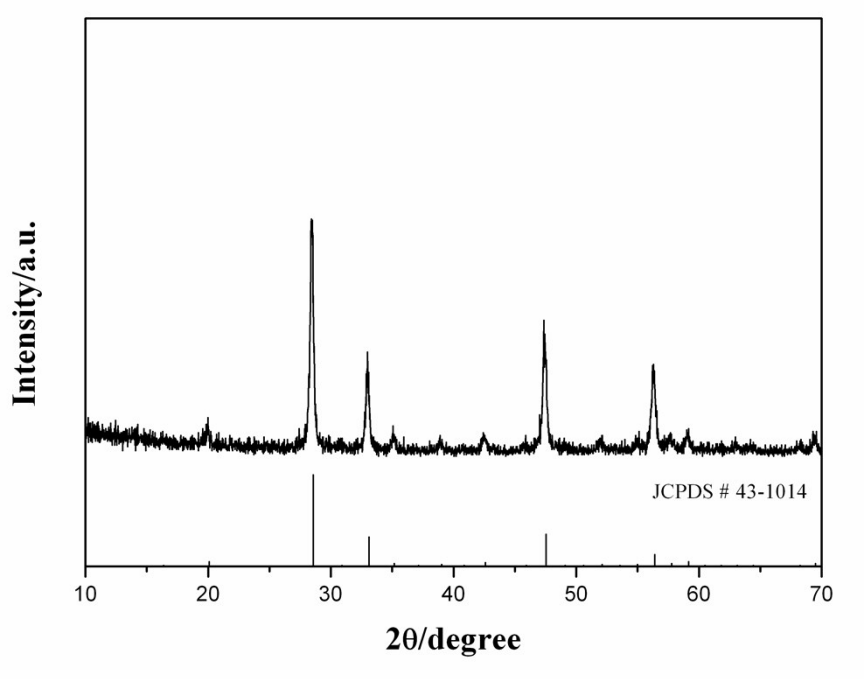

Figure S3. XRD pattern of $Gd(OH)CO_3 \cdot H_2O$:Eu after calcination at 750 ºC. Upon calcination, the amorphous $Gd(OH)CO_3 \cdot H_2O$ is converted into cubic phase gadolinium oxides (Gd_2O_3).

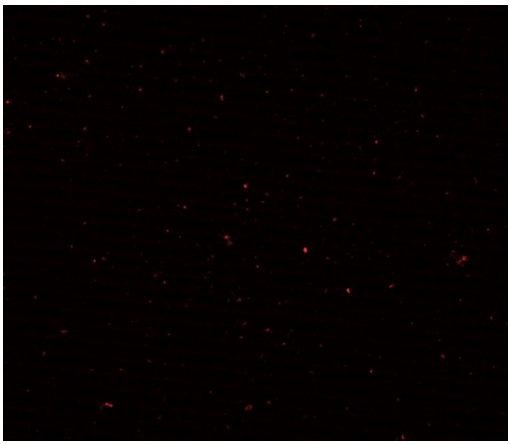

Figure S4. Confocal fluorescence microscopy image of Mesoporous-silica-coated Gd_2O_3:Eu@silica particles particles first dispersed in ethanol and then smeared on a glass slide.

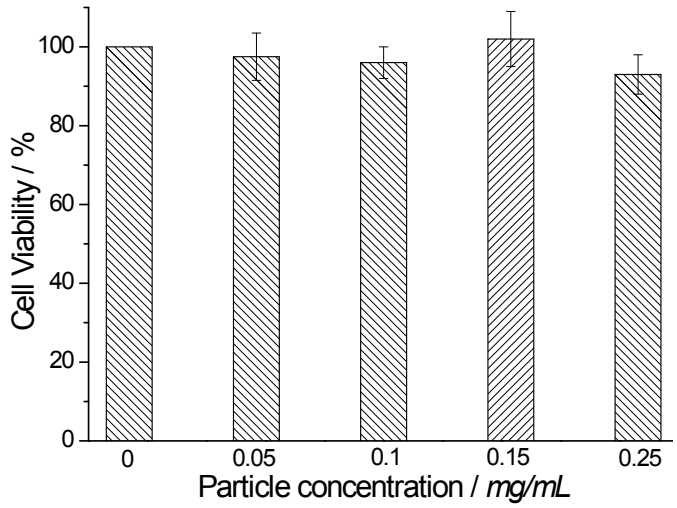

Figure S5. Concentration effect of the core-shell particles on cell viability via incubation for 72 h.

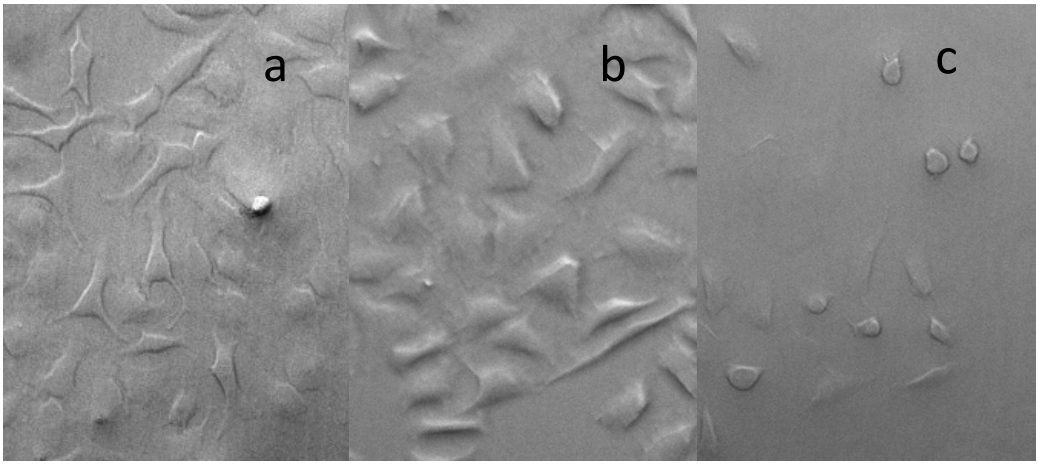

Figure S6. The morphology of the HeLa cells incubated with the DOX-loaded mesoporous particles as a function of incubation time. a) 0 h; b) 24 h; c) 72 h

References

1. L. Moscardini d'Assuncao, I. Giolito and M. Ionashiro, *Thermochim. Acta* 1989, **137**, 319.

2. W. Matijevic and W. Hsu, *J. Colloid. Interface Sci.* 1987, **118**, 506.

3. K. Makamoto, Infrared spectra of inorganic and coordination compounds. New York: John Wiley & Sons; 1963.

4. S. Lechevallier, P. Lecante, R. Mauricot, H. Dexpert, J. Dexpert-Ghys, H. K. Kong, G. L. Law and K. L. Wong, *Chem. Mater.* 2010, **22**, 6153.