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*Development of a novel functional core-shell-shell nanoparticles: from design to anti-bacterial applications*

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**Abstract:**

This article reports the synthesis and functionalization of a novel CuO@SiO<sub>2</sub>-APTES@Ag<sup>0</sup> core-shell-shell material using a simple and low-cost process. The growth, design strategies and synthesis approach are the key factors for the development of CuO@SiO<sub>2</sub>-APTES@Ag<sup>0</sup> as efficient material with enhanced antibacterial activity. We investigated the morphology, surface charge, structure and stability of our new core-shell-shell by atomic force microscopy, scanning electron microscopy, energy dispersive X-Ray, Fourier transform infrared and UV–visible spectroscopies, zeta potential measurements, and

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