SILVER NANOSHELLS: SYNTHESIS, PLASMONIC PROPERTIES AND PROSPECTS IN CANCER THERAPY

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Composite nanoparticles with dielectric cores and gold or silver shells, possessing unique optical properties, are of growing interest from the point of view of their potential use in medicine, in particular, in diagnostics and therapy of tumors.

As far as we know, only the particles with Au shells, the synthesis of which have been developed well enough for today, have been used in occasional studies till now (including *in vivo* ones) [1]. At the same time a much greater interest is attracted by similar Ag-based composite particles. It is caused by unique bactericidal properties of silver and its significantly larger resonant absorption cross section (in comparison with gold). However, the reproducible synthesis of such structures is a rather difficult problem which has not been solved completely.

In this work, results concerning the silver nanoshell's synthesis on various cores are presented. Moreover, the optical properties of such nanoshells as well as the possibility of their application to laser hyperthermia of tumors are discussed.

The general scheme of core/shell nanostructures synthesis is represented in Fig. 1.

The possibility of the synthesis of continuous silver shells on spherical SiO_2 particles and spindle-shaped particles of iron hydrous oxide is demonstrated for the first time. The procedure consists in the enlargement of preadsorbed seeding Au or Ag nanoparticles in the solution containing silver nitrate and ascorbic acid.

It is shown that, for such composite structures, the maximum of surface plasmon resonance lies in the range of 600–1200 nm, i.e., its significant batochromic shift takes place relatively to the position, characteristic for spherical silver nanoparticles (Fig. 2).

Procedure of the surface modification of core/shell nanoparticles with thiolated poly(ethylene glycol) (PEG) has been realized which provides high nanoparticle's aggregative stability in strong electrolyte (NaCl) solutions.

Quantitative information about the redistribution dynamics (on the time scale from 2 min to 24 h) of the PEG-conjugated composite SiO_2-core/Ag-shell particles between various organs and tissues of tumor-bearing mice has been obtained after particles intravenous injection in the form of colloid solution. It is revealed that such conjugated particles are characterized

rather long circulation time in blood; moreover, their high-selective accumulation in tumor takes place.

Preliminary *in vivo* experiments show that PEGylated silver nanoshells are effective sensibilizers in pulse-laser hyperthermia of tumors.

References:

[1] Loo C., Lin A., Hirsch L., Lee M.-H., Barton J., Halas N., West J., Drezek R., Technology in Cancer Research & Treatment, **1** (2004) P. 33.

Figures:

Fig. 1. General scheme of core/shell nanoparticles′ synthesis.

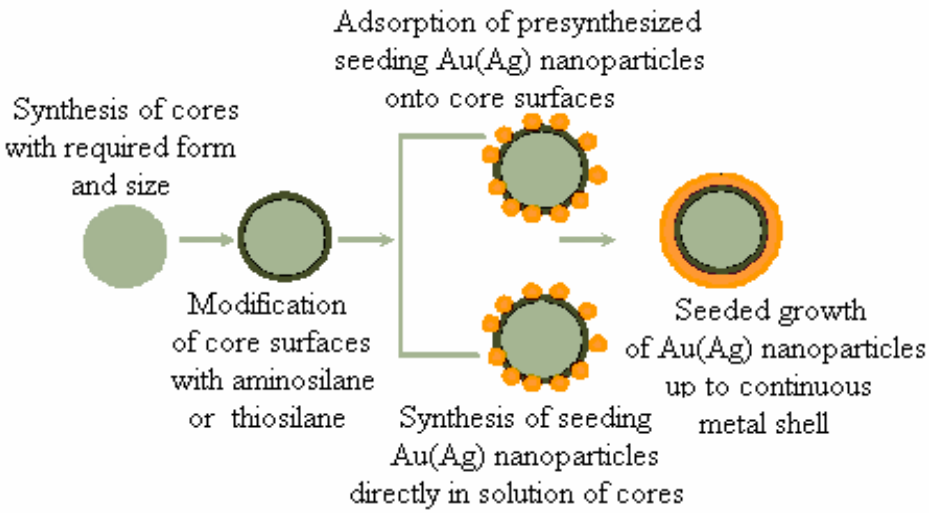
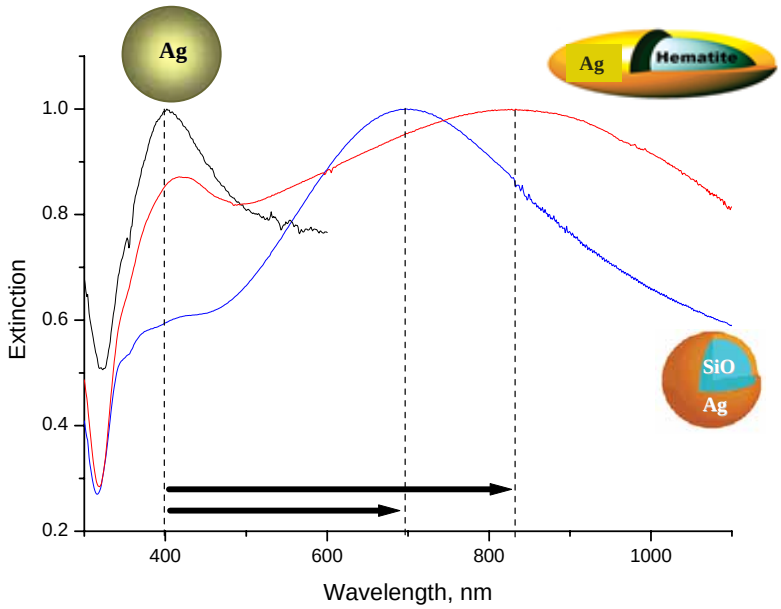


Fig. 2. Extinction spectra of silver-based nanostructures.



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