INFLUENCE OF NUCLEATION CENTERS UPON SOLVOTHERMAL GROWTH OF SILVER NANO/MICROCRYSTALS

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Abstract
Silver nano/microcrystals were obtained at medium pressure in a microwave field by using the solvothermal synthesis. In order to evaluate the nucleation centers' influence upon the formed crystals' morphology, investigations were conducted using scaffolds to stimulate their heterogeneous nucleation. Therefore, besides the silver and chloride nanocrystals used as nucleation centers, SiOx type spheres were used. The results indicate that the presence of the heterogeneous nucleation centers on the SiOx scaffolds plays a crucial role in the silver nano/microcrystals morphology.

Introduction
At present, metallic nanoparticles are widely applied in various domains, ranging from smart electronics, such as conductive films, to environmental remediation and biomedicine [1]. A range of innovative silver-based materials have been introduced in biomedical and pharmacotherapy applications. Kang et al. reported a functionalized β-cyclodextrin-immobilized silver structure as a drug carrier [2,3]. In this study, the influence of nucleation centers on the scaffold surface upon the shape of the silver nano/microcrystals was investigated.

Results and discussion
The samples, namely silver nanowires (S1AN) and silver nano/microcrystals with SiOx scaffolds (S1BSAN), were prepared by solvothermal synthesis in a microwave field. In order to perform their analysis, the samples were isolated by centrifugation and multiple stages of ethanol cleaning, after which they were air dried.
Next, the samples were characterized by scanning electron microscopy (Inspect S – FEI Company), energy dispersive X-ray spectroscopy and ultraviolet–visible spectroscopy (Jasco UV-VIS V 530 – ABL&E-JASCO).
In figure 1a Ag nanowires next to Ag particles are visible, while the figure 2b shows that silver nanowires were not detected on the SiOx type spheres, although other shapes of Ag nanoparticles are present. In figure 1c the scaffold spheres are visible at low magnification.

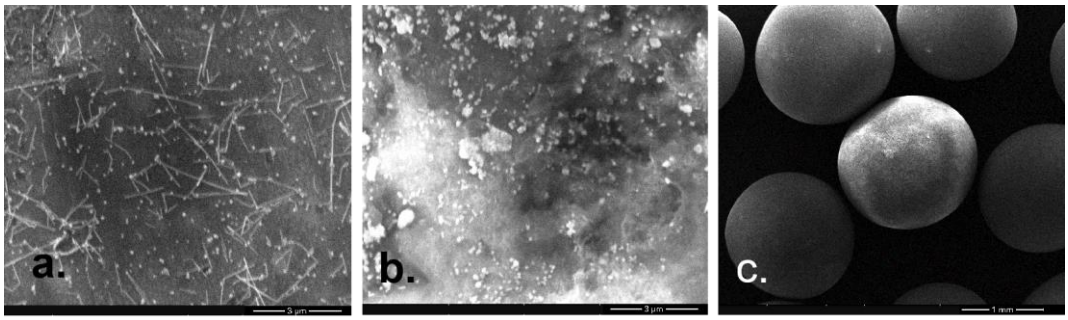

Figure 1. SEM images of a) S1AN, b) S1BSAN, c) S1BSAN samples.

The UV-VIS spectrum from Figure 2 exhibits one relatively sharp surface plasmon resonance peak at 382 nm and another peak at 352 nm that belong to the transversal SPR modes of Ag nanowires.

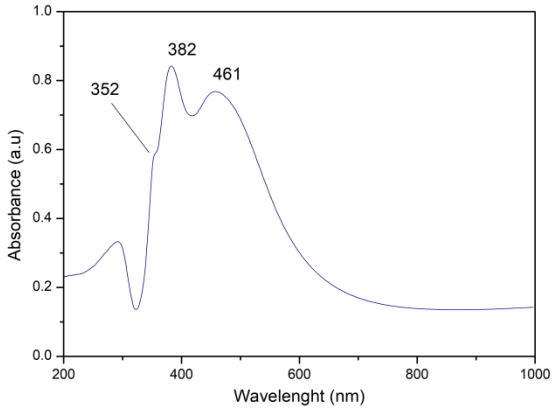

Figure 2. UV-VIS spectrum of S1AN

The 382, 352 and 421 nm SPR peaks suggests that the sample, as seen in the previous SEM images, contain both Ag nanowires and Ag nanoparticles.

Conclusion

It was observed that the presence of the heterogeneous nucleation centers, which compete the AgCl nanocrystals in the nucleation process, determines the entire modification of the morphology for the nano/microcrystals which were previously formed. This fact has a great potential for practical application, e.g. in choosing the type of reactor used for the synthesis process of the silver nano/microcrystals.

Acknowledgements

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