

SYNTHESIS AND CHARACTERIZATION OF INDIUM NANOPARTICLES AS PRECURSOR FOR SOLAR CELLS

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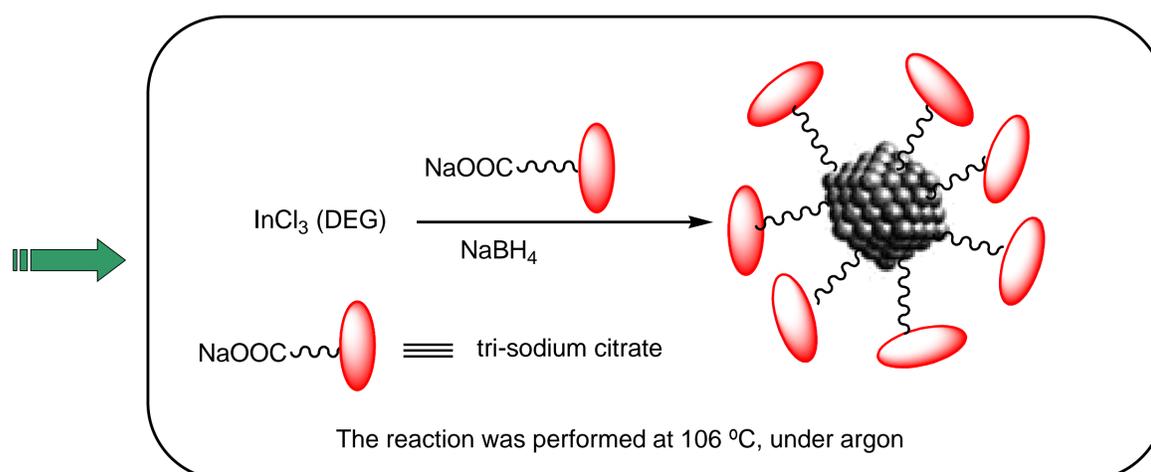
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INTRODUCTION

In(0) nanoparticles with tunable size, as a part of the rapid development in nanomaterials research, have been used as source to prepare solar cell [3] and as catalyst to promote anisotropic growth of III-V and II-IV semiconductor nanowires and nanorods via a solution-liquid-solid mechanism [1-2].

In order to prepare solar cell, with a considerable efficiency, the synthesis of In(0) nanoparticles, as precursor for these cells, is going to be reported here.

CHEMICAL SYNTHESIS



RESULTS AND DISCUSSIONS

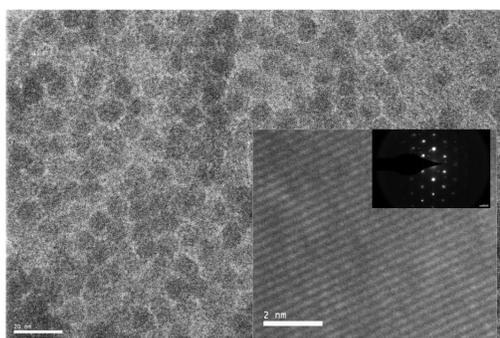


Figure 1. TEM pictures of the In(0) nanoparticles covered with tri-sodium citrate and HR-TEM image (inset) and electron diffraction (inset)

TEM and HR-TEM: TEM indicates that In particles have a spherical shape with dimensions around 10-20 nm. Few particles with larger diameter (50 nm) were also observed.

Electron diffraction (SAED) (inset) proves that nanoparticles are monocrystalline, not aggregation of small nanoparticles; also the HR-TEM image (inset) confirms the monocrystallinity of particles.

Size distribution: the nanoparticles have a diameter in the range $\Phi = 7 - 40$ nm. The average diameter is 18.72 nm.

UV-VIS: The surface plasmon resonance for In(0) nanoparticles is typically specified to values ranging from 240-290 nm. The shape of absorption spectra suggests the presence of small nanoparticles (<15 nm) with $\lambda_{\max} = 259$ nm; also the shoulders at high wavelength could indicate the larger nanoparticles obtained as observed by Feldmann [4].

Powder X-ray diffraction confirms the existence of metallic indium as major crystalline phase.

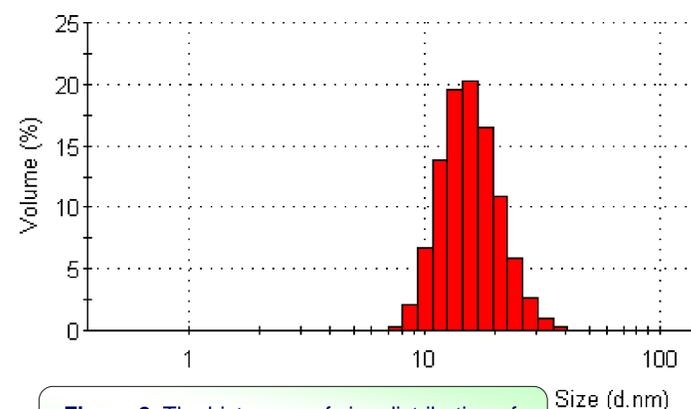


Figure 2. The histogram of size distribution of In(0) nanoparticles covered with tri-sodium citrate

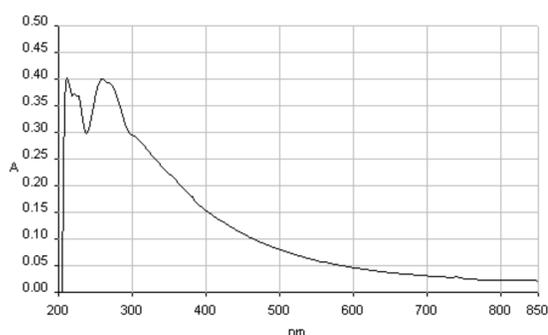


Figure 3. UV-VIS In(0) nanoparticles covered with tri-sodium citrate in EtOH

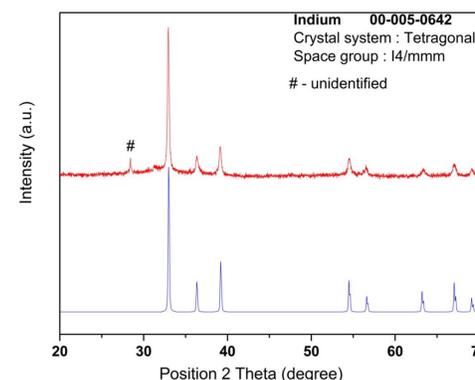


Figure 4. Powder X-ray diffraction of In(0) nanoparticles covered with tri-sodium citrate

CONCLUSIONS

1. We have prepared indium nanoparticles, where the spherical particles are covered with a monolayer of tri-sodium citrate;
2. The temperature and the concentration of reactant are important parameters in synthesis: the temperature increase leads to a decrease of nanoparticles size, increasing the concentration of NaBH_4 decreases the size of nanoparticles;
3. The dimensions of nanoparticles are in the range $7 \div 40$ nm.

References

1. G. Chen, L. Wang, X. Sheng, D. Yang, *J. Sol-Gel Sci. Technol.*, **2011**, 58, 162;
2. E. Eustis, M. El-Sayed, *Chem. Soc. Rev.*, **2006**, 35, 209;
3. R. Takahashi, I. Yamada, A. Iwata, N. Kurahashi, S. Yoshida, S. Sato, *Appl. Catal. A*, **2010**, 383,134;
4. C. King, C. Feldmann, *Chem. Mater.*, **2011**, 23, 4982.

Acknowledgements

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