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Project:	Simple gram-scale synthesis of red-emitting silicon nanoparticles
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Introduction

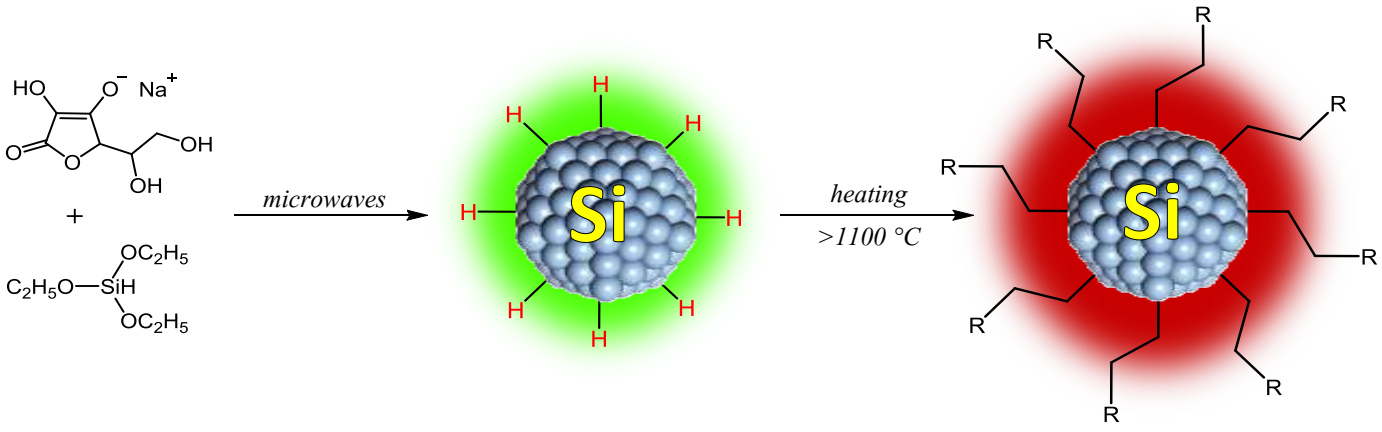
Fluorescent nanoparticles are an interesting material for many applications, due to their size-tunable emission spectrum and stability against photobleaching. Among these, silicon nanoparticles (SiNPs) are particularly sought after, due to the low toxicity, low cost, and high abundance of the starting material. Unfortunately, synthetic routes for SiNPs typically suffer from low yields and harsh reaction conditions, which has so far limited their widespread use.

The aim of this project is to find an easy method for the preparation of large quantities of size-tunable SiNPs. More specifically, the particles should have an emission maximum in the infrared region, with a quantum yield >20%, as such particles can be used for highly-efficient solar cells prepared later on.

Approach

SiNPs are produced using an adapted version of a recently-developed microwave-assisted reaction.[1] This reaction is capable of producing gram-scale quantities of SiNPs in just 5 minutes, yet the use of DMSO as solvent means the work-up is time-consuming. Therefore, the first step will be to transfer the reaction to a different, more volatile solvent.

Next, the emission wavelength of the nanoparticles has to be shifted to the infrared region, to make them useful for solar cell applications. So far, the longest attainable wavelength is 650 nm. This is thought to be due to structural defects in the SiNPs. To study this, the SiNPs will be heated to temperatures >1100 °C. At these temperatures, it is expected the structural defects will be removed. After thermal treatment and passivation, the optical properties of the SiNPs will be studied again, to see if the emission maximum has been shifted to longer wavelengths (>850).



Acknowledgements

This research is financed by the NWO programme Mat4Sus (Materials for Sustainability).

Reference

1) Pujari, S.P., Driss, H., Bannani, F., van Lagen, B., Zuilhof, H. (2018); One-Pot Gram-Scale Synthesis of Hydrogen-Terminated Silicon Nanoparticles. *Chem. Mater.* **30**, p. 6503-6512