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## **Investigation of the growth of nanoparticles with controlled size and controlled surface chemistry, which will be used as nanofillers in polymers**

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# Investigation of the growth of nanoparticles with controlled size and controlled surface chemistry, which will be used as nanofillers in polymers

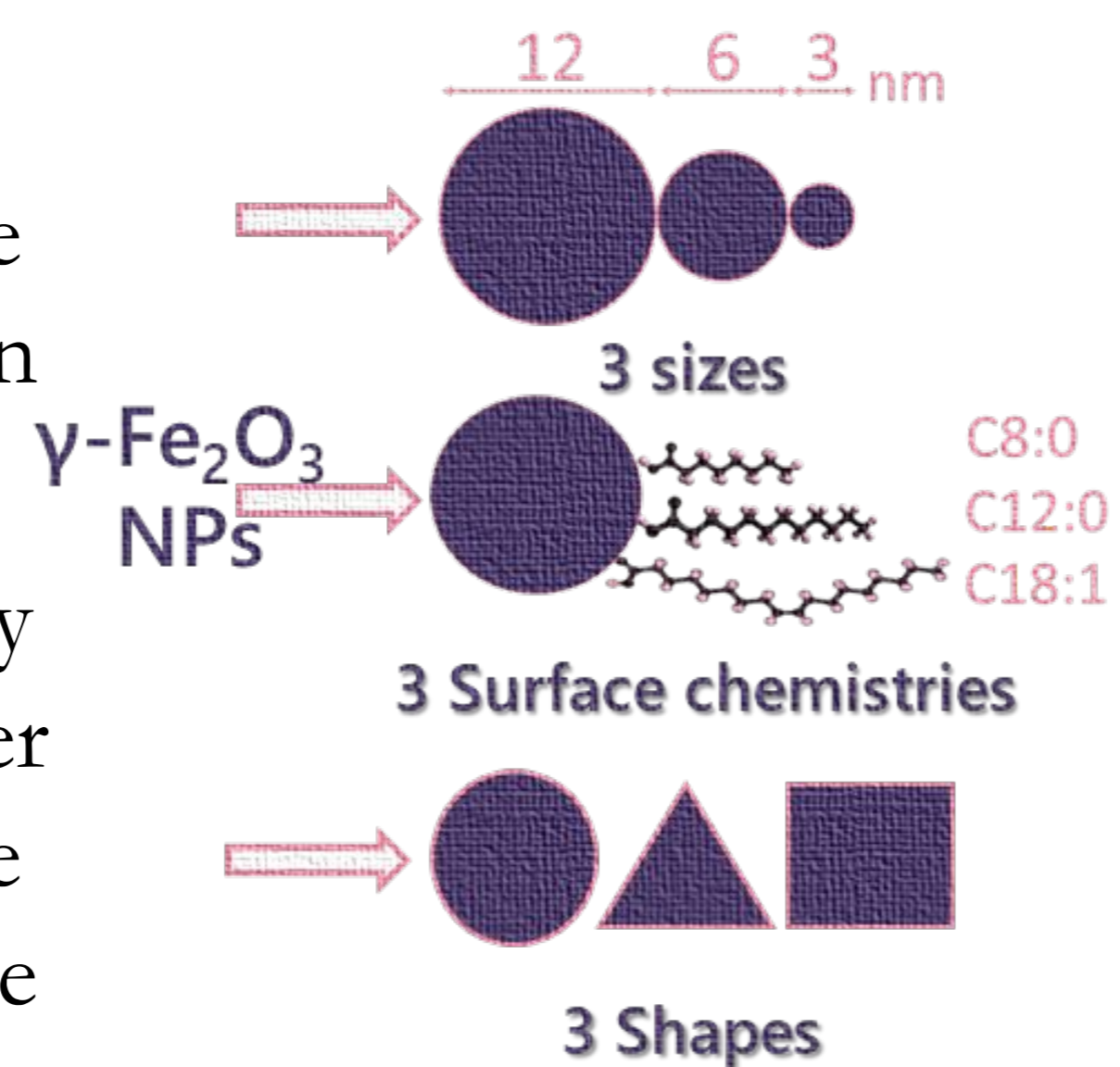
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## Context

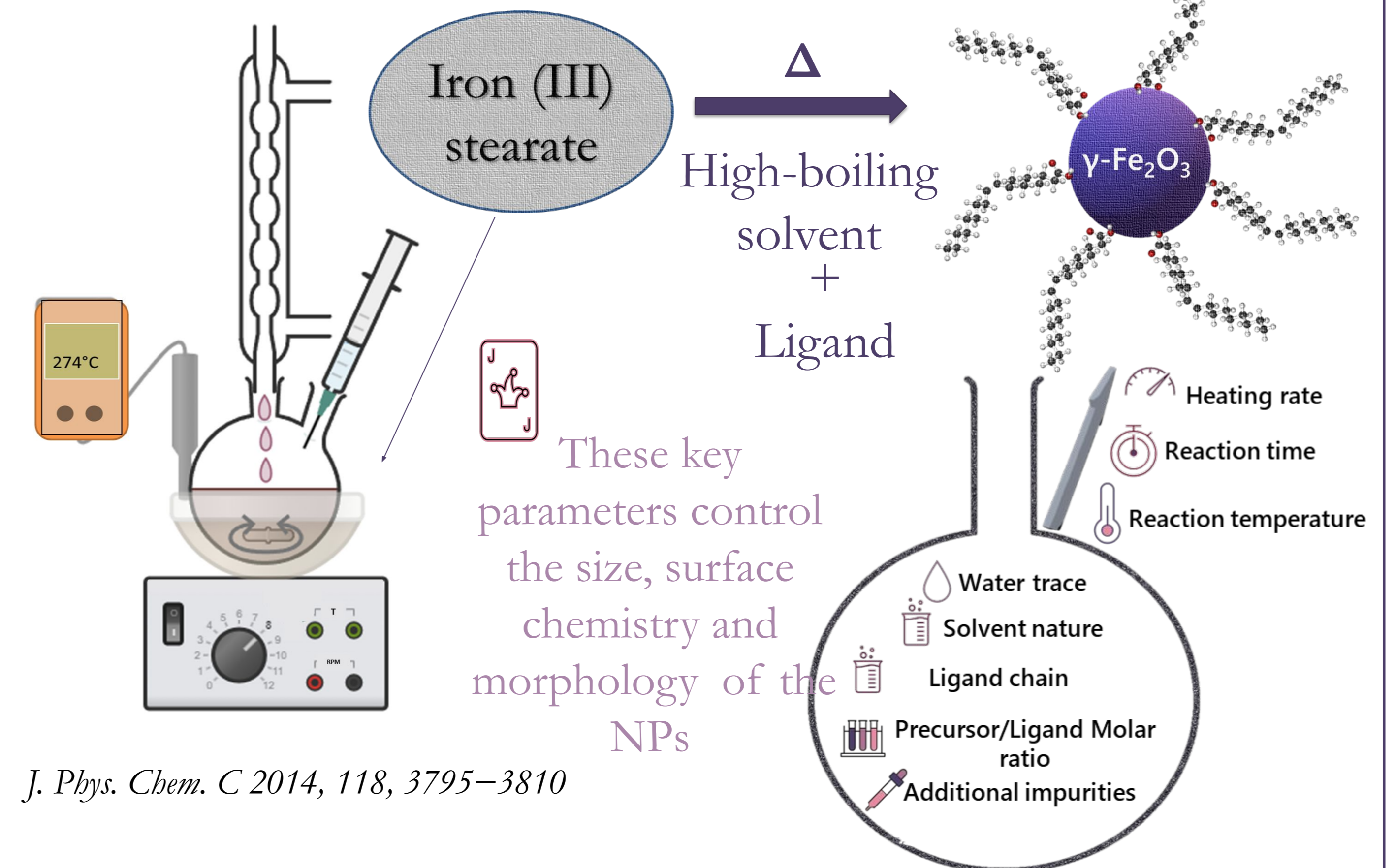
To Investigate the effects of size, surface chemistry and morphology of iron oxide nanofillers on the mechanical and thermal properties of nanoreinforced polymers:

- Ligand-coated maghemite ( $\gamma\text{-Fe}_2\text{O}_3$ ) nanoparticles are synthesized by the thermal decomposition of an organometallic precursor.
- Growth mechanisms are revealed by studying the effect of each key parameter (mentioned in the next section) on the nanoparticle characteristics (size, surface chemistry, morphology).
- Key parameter effects are exploited to control the characteristics of the nanoparticles to be incorporated. Envisaged characteristics: see the scheme



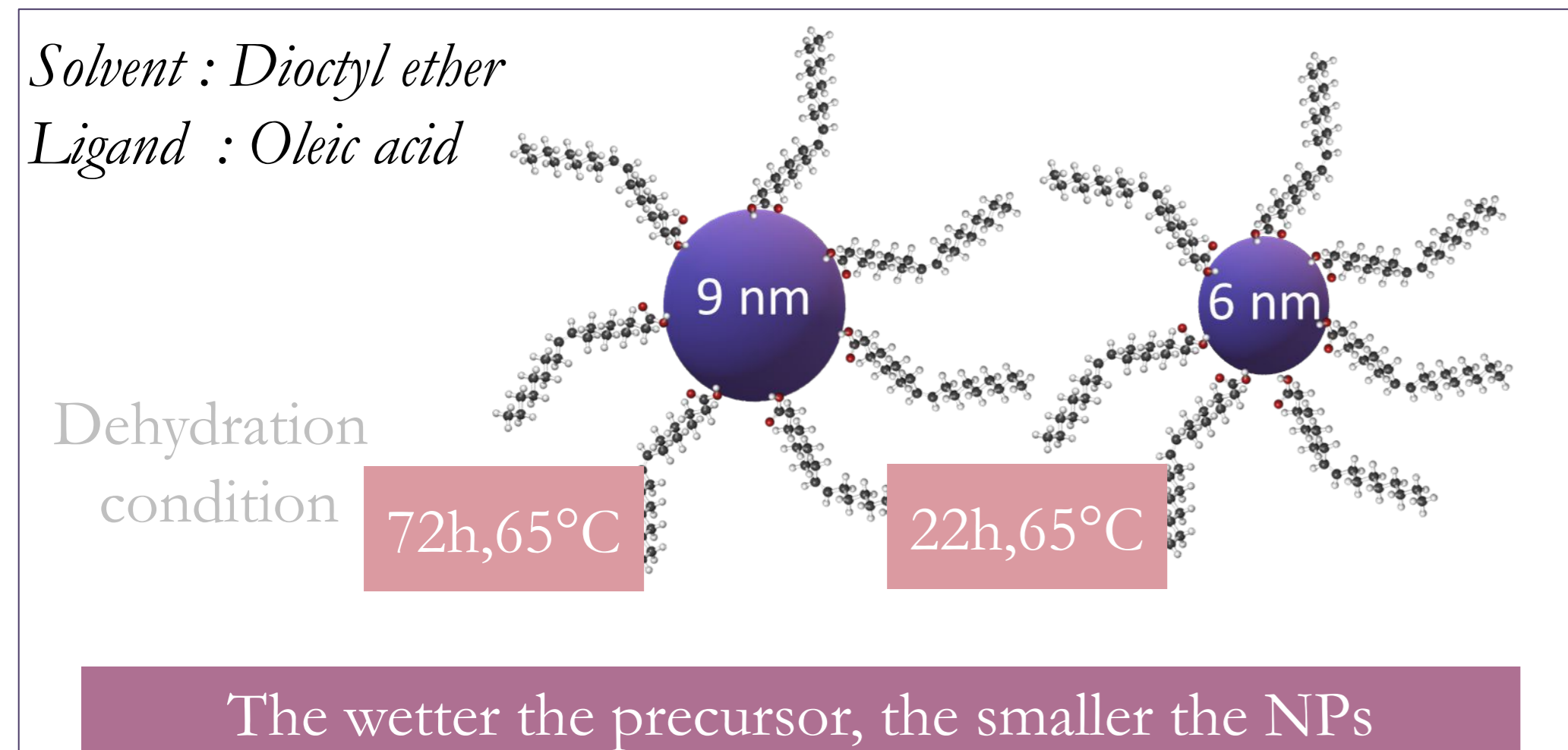
## Synthesis of ligand-coated $\gamma\text{-Fe}_2\text{O}_3$ nanoparticles

Thermal decomposition process (under reflux)

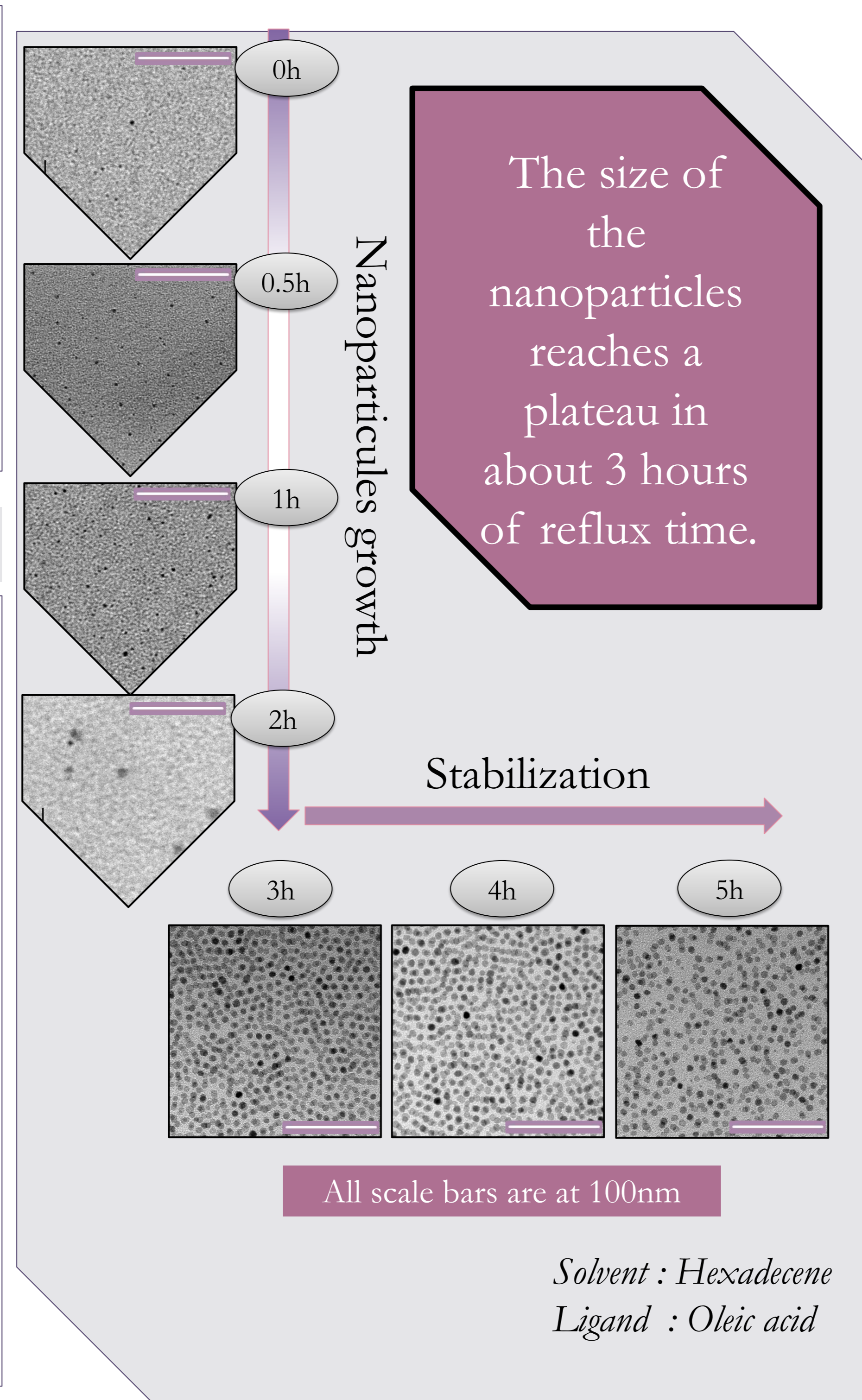


## Key parameters for controlling nanoparticles growth

### Water trace



### Reflux time



### Precursor impurities

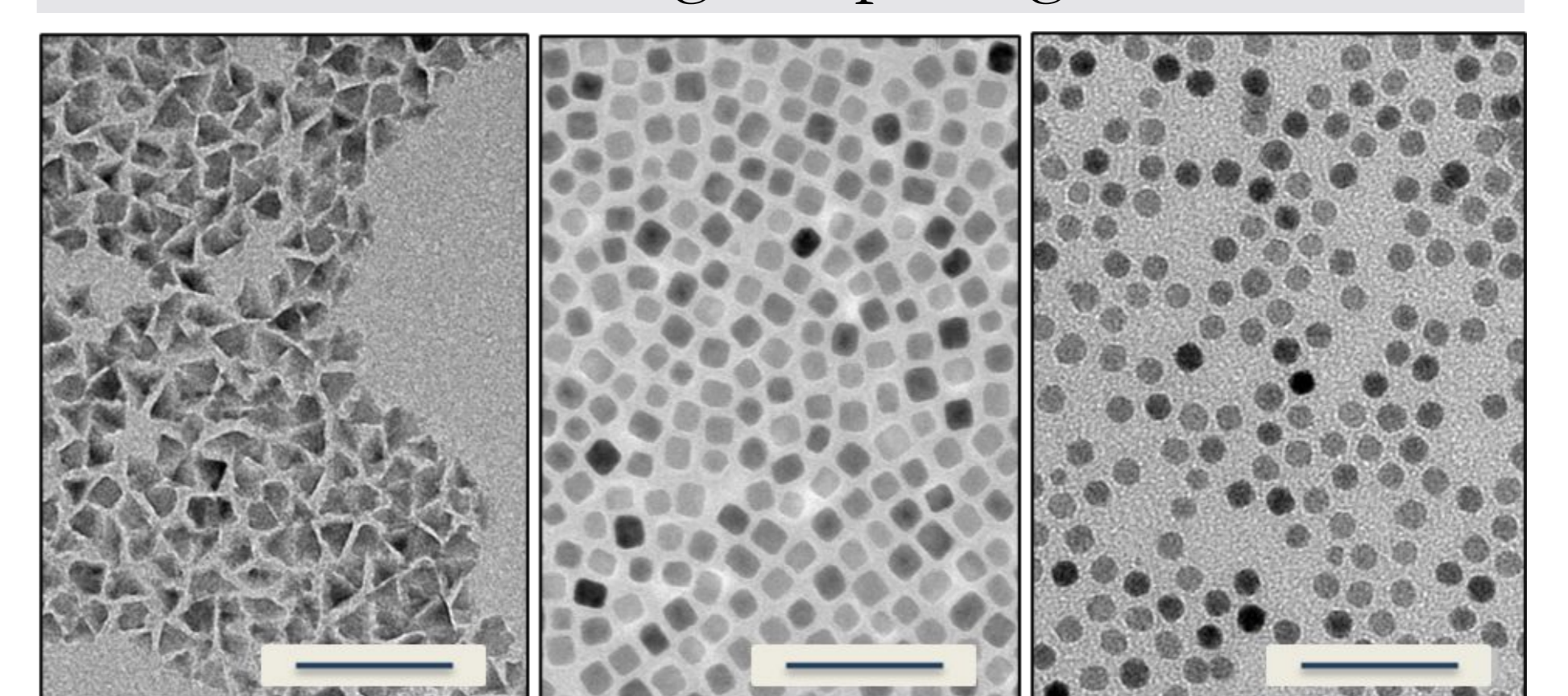
Synthesis of the precursor



Microanalysis of the precursor used (% atomic)

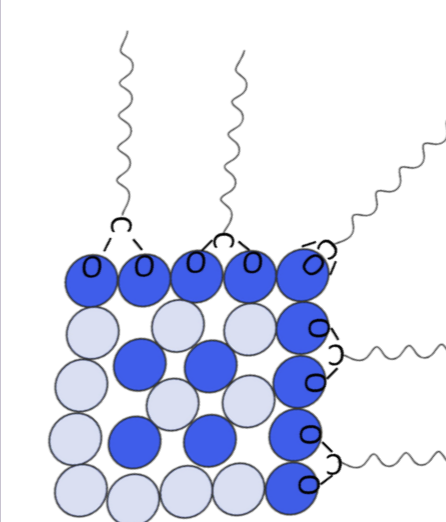
	25	43	100
%Fe	25	43	100
%Na	48	54	0
%Cl	27	3	0

Resulting morphologies



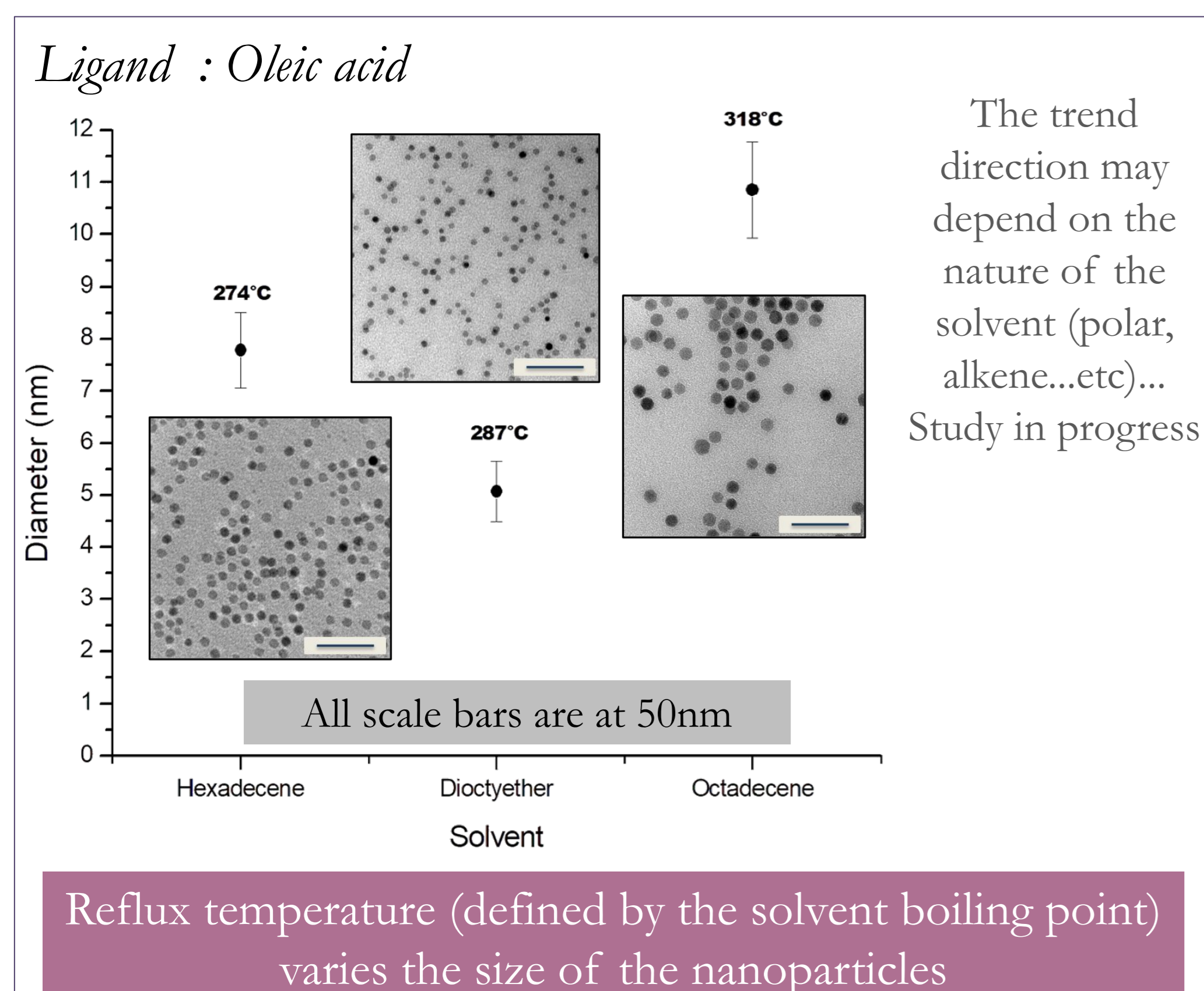
All scale bars are at 50nm

Solvent : Dioctyl ether  
Ligand : Oleic acid



Poisoning the surface with different agents varies the growth rates on low index planes such as {111}, {110} and {100}.

### Reflux temperature



## Conclusion

## Perspectives

- Series of experiments are conducted to understand the growth mechanism of iron oxide nanoparticles synthesised by thermal decomposition of an organometallic precursor.
- The effects of trace of water, temperature & reflux time, impurities in the precursor were observed.

- The understanding of the growth mechanism of the nanoparticles will be extended by studying the other key parameters mentioned in the "synthesis" section, and will be supported by a theoretical study on the solubility of the synthesis reagents.
- The study of control parameters will be explored to produce nanoparticles with controlled size, surface chemistry and morphology with low size dispersion to serve as nanofillers for a polymer matrix.
- The incorporation of nanoparticles into a polymer will reveal the evolution of the mechanical and thermal properties of the nanocomposite according to the characteristics of the inserted nanoparticles.