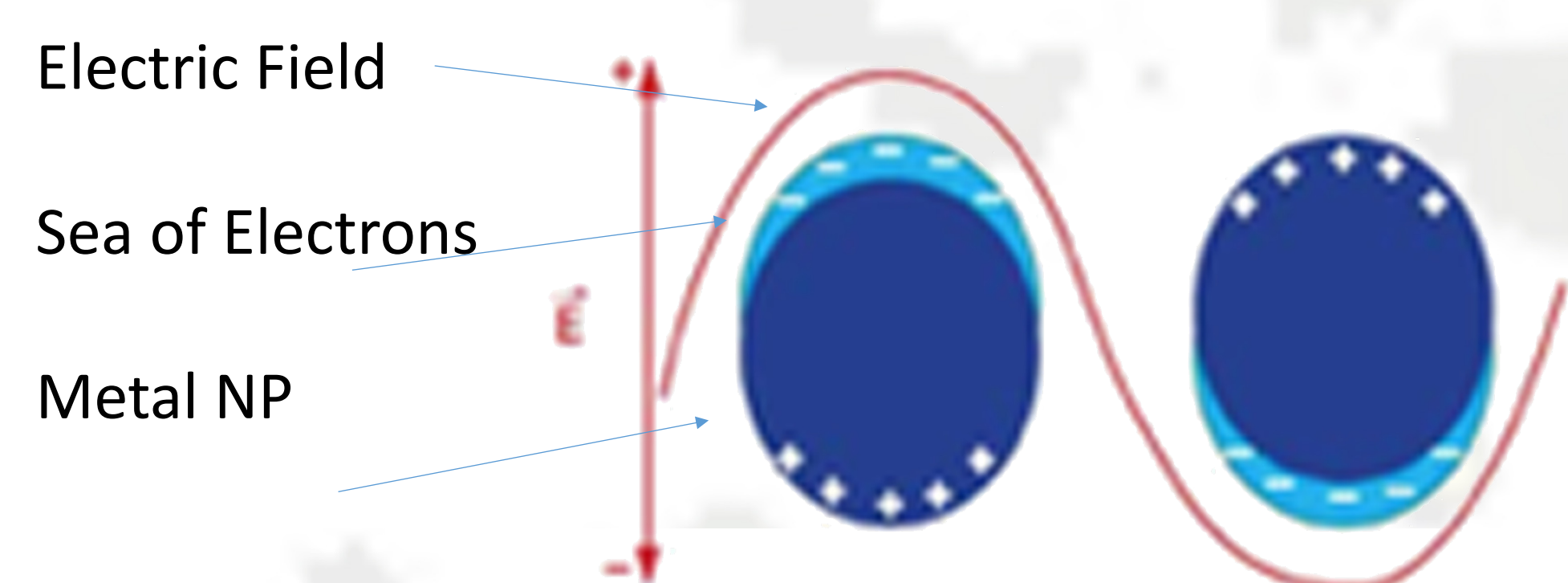


Electrolyte Assisted Self-Assembly of Gold Nanocubes at a Liquid | Liquid interface

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1. Introduction:

Metal nanoparticles (NPs) have a sea of free electrons, which oscillate in the presence of the electric field of light. This oscillation, termed a surface plasmon resonance (SPR), is strongest in the visible region for noble metal NPs such as gold. The SPR is strongly dependent on the size, geometry and local dielectric environment of the NPs¹

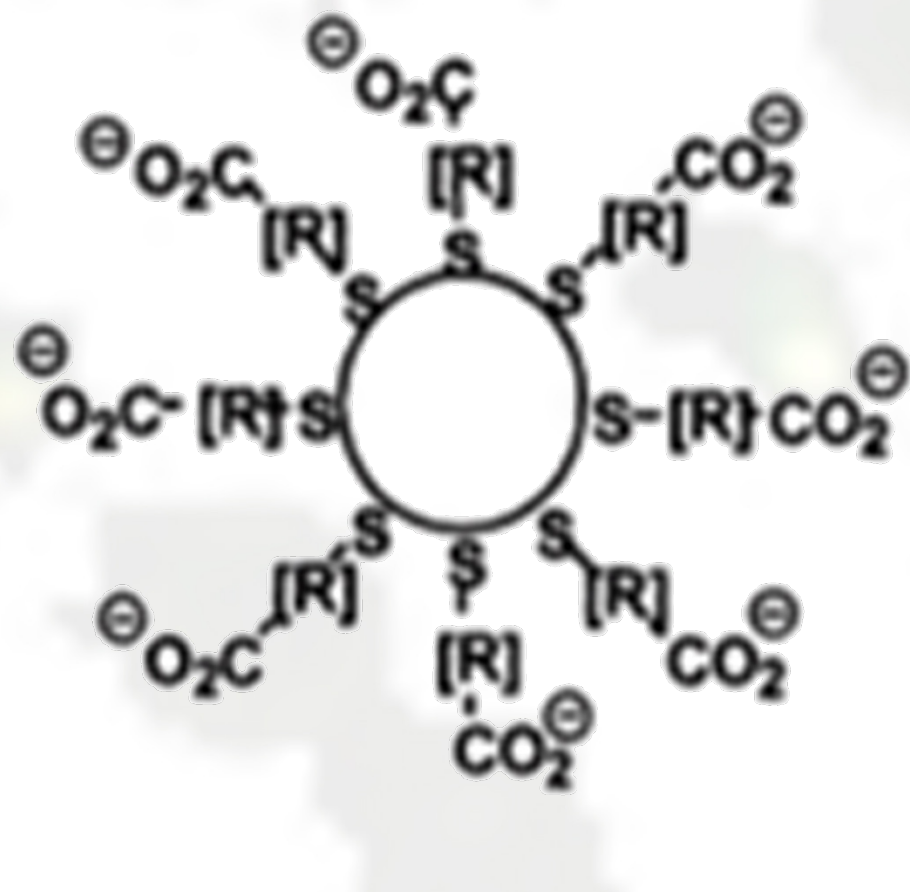


The plasmons of neighbouring particles can interact if the distance between them is small. A method of controlling this interparticle distance is to screen the electronic repulsion between charged ligands with an electrolyte.

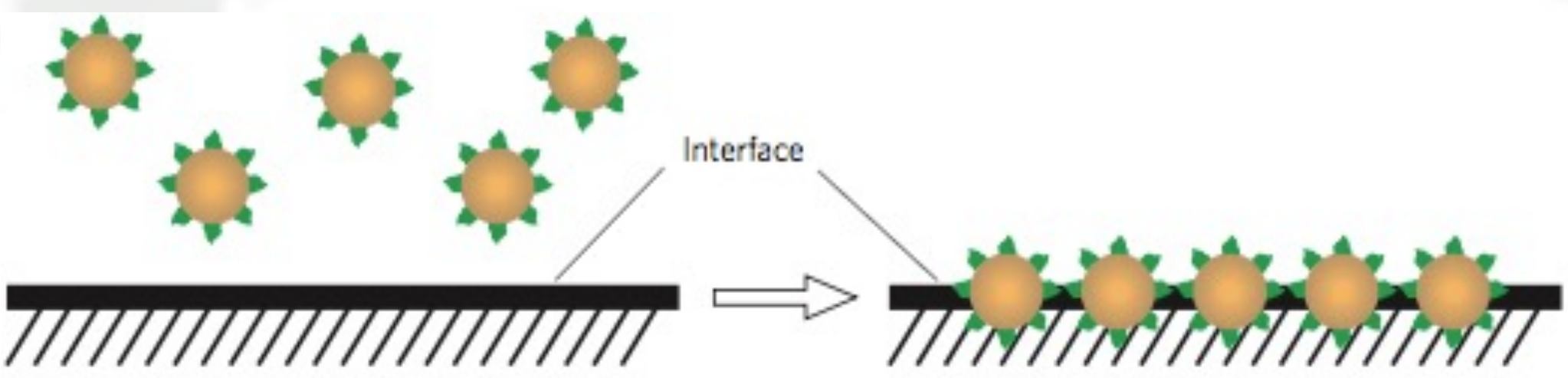
The aim of this project is to determine and quantify the control that can be exerted over interparticle distance, through use of an electrolyte in the self-assembly of gold nanocubes.

4. Self-Assembly

A ligand exchange was performed at with 11-mercaptoundecanoic acid (MUA). This provided the necessary electronic repulsion; however it made cubes pH sensitive.⁴



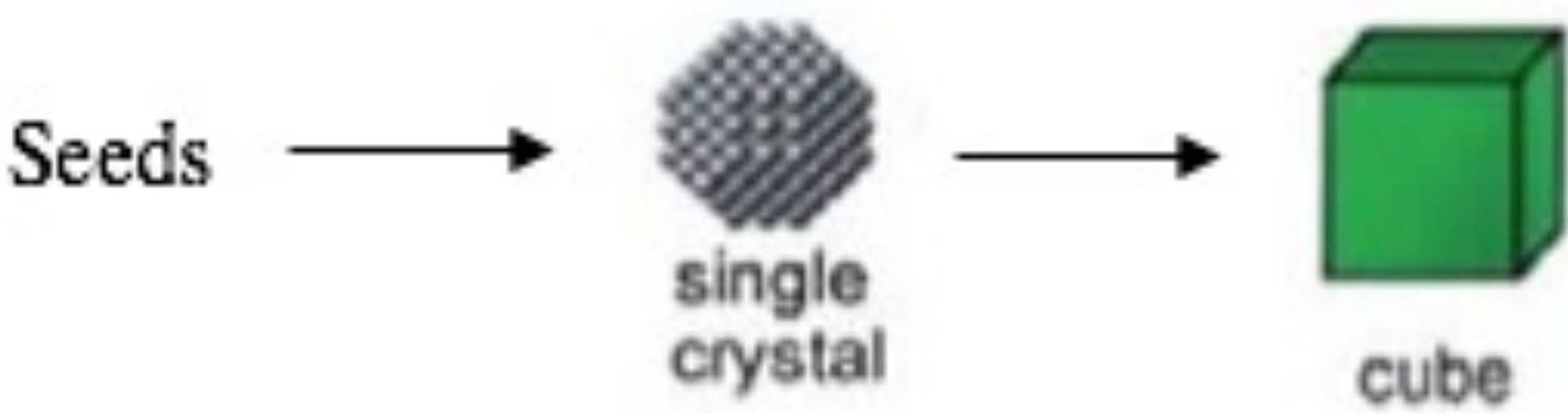
We found that the concentration of salt, varied from 20mM to 100mM in the aqueous phase, made no difference to the amount of nanocubes that assemble at the 1,2-dichloroethane | water interface.



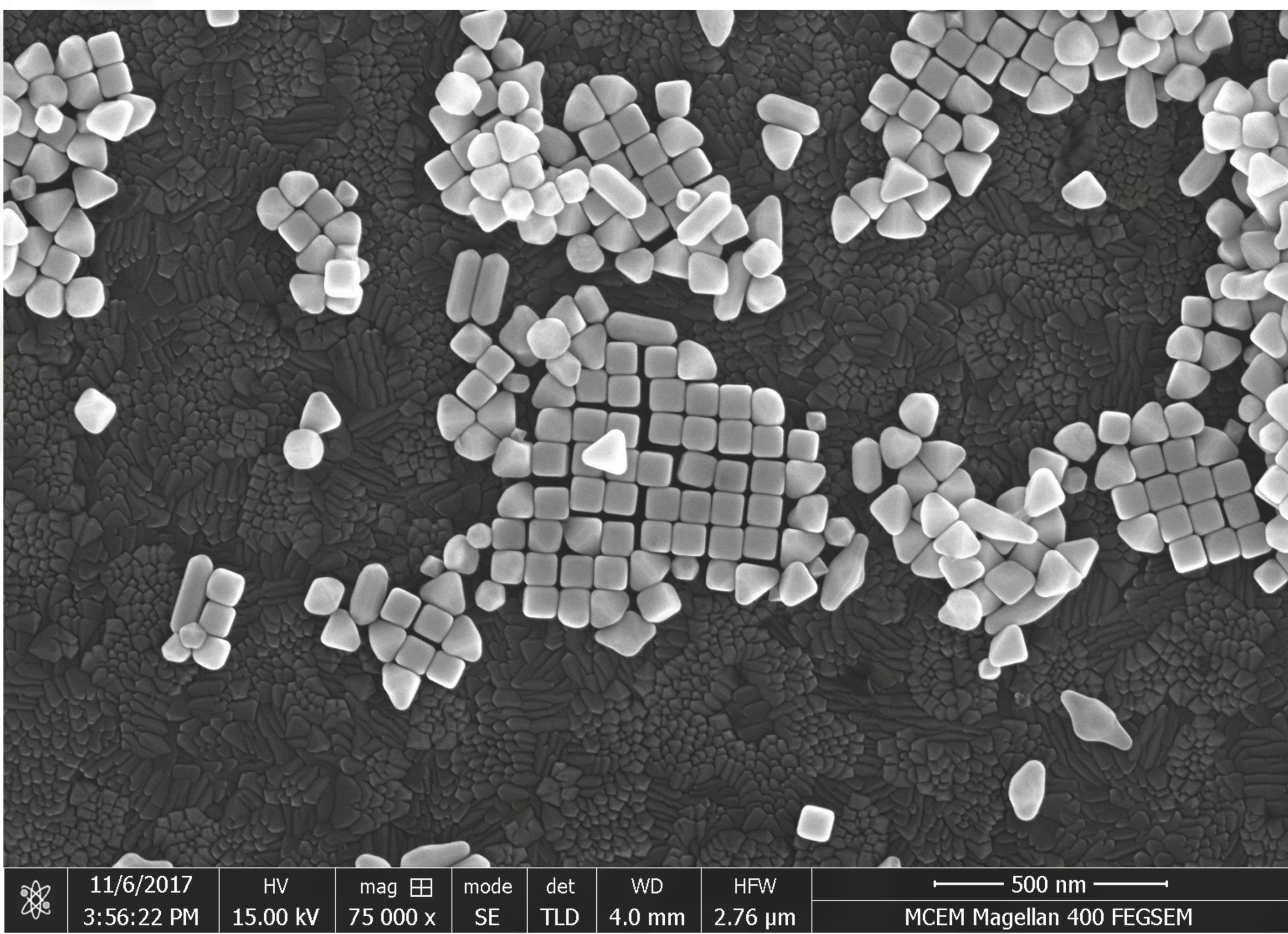
This is likely due insufficient electrolyte, although it may be due to pH preventing the deprotonation of the carboxyl group.

2. Synthesis

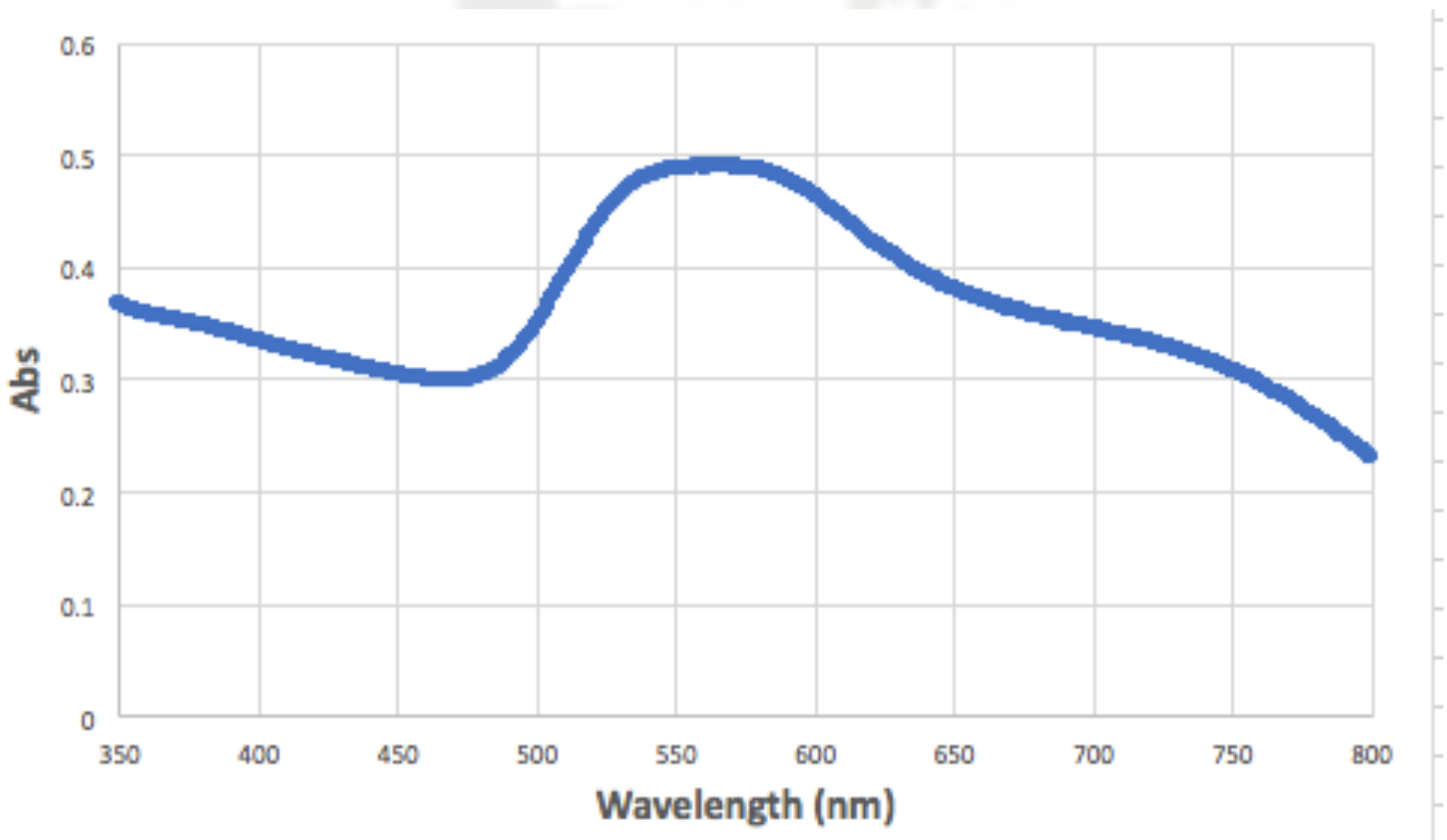
A two variants of of an established, seed mediated, synthesis were used,² one with RT NaBH₄, the other with cold NaBH₄. We found that cold NaBH₄ produced the desire particles.



3. Characterisation



Above. Scanning Electron Microscopy (SEM) image of cubic NPs used for self-assembly. Synthesis and imaging preformed by Wenming (Simon) Tong.



The UV-Vis spectrum of the synthetic cube sample shows a strong absorbance at 560nm,³ which is characteristic for nanocubes. SEM could be used to fully characterise the sample and determine the yield.

5. Future Work

Quantifying the control that can be exerted over interparticle distance through the screening of electronic repulsion with electrolytes is important to the the controlled self-assembly of NPs at interfaces. Future work could focus on varying the concentration, identity, and complexity of the salt used, in order to identify if those factors influence the final properties of a NP layer.

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