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NANYANG TECHNOLOGICAL UNIVERSITY

# URECA

*Undergraduate Research Experience on CAmpus*

**Category: 2**
**FYP-URECA Project ID: MSE08035**
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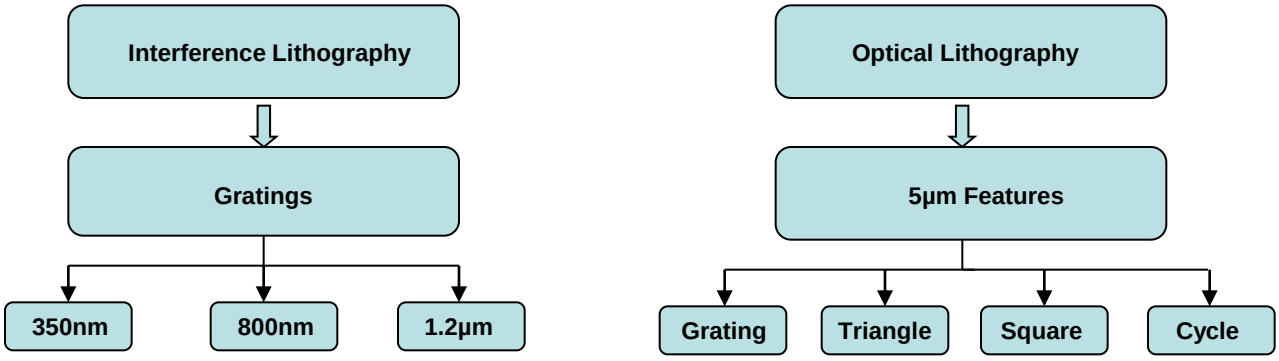
**School of Materials Science and Engiineering**

## Introduction:

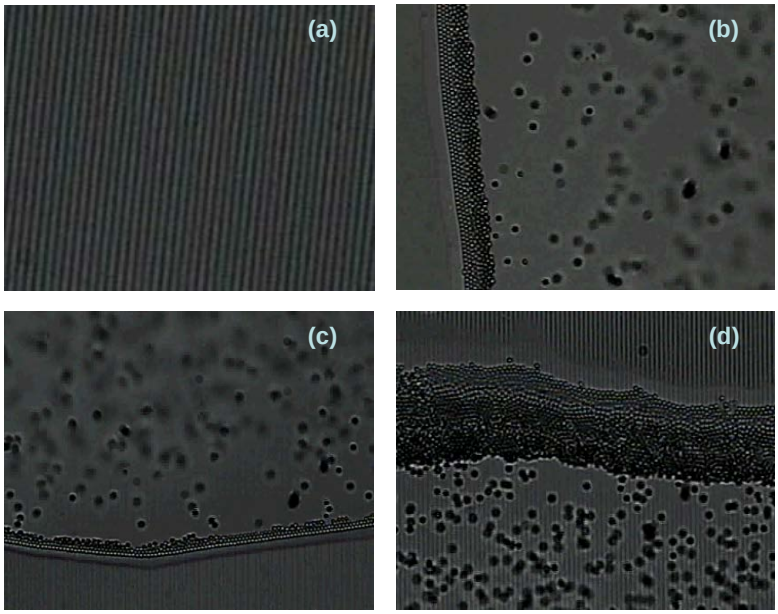
**Colloidal spheres play an important role as building blocks to fabricate basic photonic materials and lithographic masks, as they can self assemble into close packed 2D and 3D periodic arrays. In order to obtain more complex structures, patterned substrates have been used to direct the colloidal crystallization. However, the detailed mechanism of self-assembly onto a patterned substrate is not yet fully understood. Therefore, in situ visualization of colloidal self-assembly process on patterned substrate could be valuable. In this work, we investigated the size effect of the periodic patterns on dynamic colloidal self assembly during horizontal evaporation in a sessile drop.**

## Template Fabrication:




## Real Time Visualization:

**Monodisperse poly-styrene (PS) colloidal spheres were synthesized using an emulsifier-free emulsion polymerization method. With potassium persulfate as the initiator, the surface of colloidal spheres was terminated with sulfate group and thus have a negative charge.**




**In our experiments, the concentrations of PS suspension ranged from 0.05wt% to 0.3wt%. The charge neutrality of PS spheres was varied by adding three types of surfactants, i.e. nonionic surfactant Igepal CO720 (0.3mmolL-1), anionic surfactant sodium dodecyl sulfate (SDS, 3.6mmolL-1), and cationic surfactant dodecyltrimethylammonium bromide (DTAB, 3mmolL-1).**

**The real time video monitoring revealed that the hydrophobic interactions between PS spheres and patterned substrate have great impacts in the colloidal self-assembly process. Various assembly behaviors were observed depending on different crystal growth conditions mediated by size effect of patterned substrate and surfactants addition to the sessile drop.**

Figure (a), Gratings generated by interference lithography. (b), Colloidal self-assembly on flat substrate without pattern. (c), Colloidal self-assembly on gratings with periodicity of 800nm. (d), Colloidal self-assembly on gratings with periodicity of 1.2μm.

**Project Title: Real Time Visualization of Template Directed Colloidal Self Assembly**
**Supervisor: Assoc Prof Wong Chee Cheong**