

# ITC Research Student Seminar

## 2016-17

**Date:** 23 January 2017 (Monday)  
**Time:** 4:00 pm – 5:00 pm  
**Venue:** Room ST602, 4D Theatre, The Hong Kong Polytechnic University

**Speaker:** Chen Jianming (PhD Student)  
**Topic:** Study of Recombinant Spider Eggcase Silk Proteins for Functional Applications

**Speaker:** Qiu Lu (MPhil Student)  
**Topic:** Theoretical Understanding on the Formation Mechanism of Two Dimensional Phosphorene

### Abstracts

**Topic:** Study of Recombinant Spider Eggcase Silk Proteins for Functional Applications

Task-specific spider silks, assembled under different combination of proteins, enable spiders to perform several functions, including prey capture, locomotion and offspring protection in egg cases. Distinctive mechanical advantages of silk proteins, along with their intrinsic biocompatibility and biodegradability, make silk-based spheres be of considerable interest in applications for drug delivery. Here, a spider eggcase silk protein, from a black widow, is genetically engineered and then assembled into spheres as rapidly as 10s in a lubricant-based system. Thanks to the unique amphiphilic structure, the underlying mechanism of the formation of spheres is revealed by the micelle theory. The structure and physicochemical properties of silk spheres are characterized by FTIR, SEM, TEM, and AFM. For drug delivery application, silk spheres are loaded with doxorubicin and their loading and release profiles are studied. Under various triggers, the doxorubicin can be released from silk spheres for cancer therapies.

**Topic:** Theoretical Understanding on the Formation Mechanism of Two Dimensional Phosphorene

Since the rising of graphene, great achievements have been made in the field of two dimensional (2D) materials. Among them, phosphorene, as a newly emerging 2D material, is now attracting great attention due to its unique properties and potential applications in the areas as electronics, batteries, optoelectronics and so on. To realize these applications, the synthesis of large area, high-quality phosphorene single-layer films is a critical step. However, in contrast to the well-researched graphene, the fabrication of phosphorene is only limited to simple exfoliation and the theoretical research is far immature. Thus, in this study, a global searching method to find out the possible phosphorene isomers was proposed. More than 10 phosphorene isomers were found highly stable and their electronic properties explored. Further, the potential of growing monolayer phosphorene films with chemical vapor deposition (CVD) method was investigated by ab initio calculations. We found that black phosphorene is most likely to be synthesized on tin surface while blue phosphorene, surprisingly, can be grown on most metal surfaces, especially on gold and silver surfaces. This may inspire many experimental studies to realize the synthesis of 2D phosphorene films for its promising applications.

~ All are welcome ~