

## **Tuning the morphologies, ordering and stability of self-assembly peptide on two dimensional materials: application for sequential-assembly growth of two peptides**

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### **Abstract**

Developing various morphologies and a stable nanostructure of self-assembly peptides on a two-dimensional substrate has played a key role for bioelectronics and biomedical applications [1-3]. Here, the absorption and self-assembly characters of two artificial peptides with opposite charges are investigated on graphite and MoS<sub>2</sub> surfaces. The ex-situ atomic force microscopy (AFM) results show that their morphologies, ordering and stabilities on graphite and MoS<sub>2</sub> surface are different. The negatively charged peptides self-assembled into an ordered phase on graphite surfaces with six-fold symmetry in a wide range of peptide concentrations. On MoS<sub>2</sub> surfaces, the peptide shows a morphology change from randomly orientated nanowires to ordered aligned nanowires as decreasing the peptide concentration. While the positively charged peptide shows a disordered phase such as wavy structures or aggregates on both substrates. The affinity constants of both peptides on graphite and MoS<sub>2</sub> were estimated by concentration-dependence experiments. The stability against washing by water was also examined for both peptides self-assembled on graphite and MoS<sub>2</sub>. We found that negatively charged peptides have high affinity constant and stability on both substrates. The results suggest that the stability of self-assembled peptides could be determined by their affinity constants on substrates. Finally, by using the negatively charged peptides as a stable template, we have demonstrated a sequential self-assembly of two peptides on a graphite surface. The template peptides which was self-assembled first, show an ability to maintain their self-assembled structures and guide the secondary self-assembled peptides. Both of the peptides show same orientations and ordered structures on graphite surface. These results will open a new door for a development of biosensors with multiple biological probes on a functional surface such as graphite and MoS<sub>2</sub>.

### **Reference**

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