

Organic Solvent-Mediator for Controlling Self-Assembly of Peptides on 2D Materials

(D)Robert Ccorahua¹, (M2)Hironaga Noguchi¹, (M1)Kazunori Motai¹, Yuhei Hayamizu^{2,*}

¹Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro-ku, Tokyo 152-8550, Japan

*E-mail: hayamizu.y.aa@m.titech.ac.jp

The controllable nanoscale self-assembly of biomolecules, such as peptides, on 2D materials is an important issue in establishing functional bio/solid interfaces for biosensors. So far, we established method to control the self-assembly by applying electrochemical bias¹ and designing new sequence of peptides². Herein, we evaluated a method to control the self-assembly process of Y(GA)₄Y peptide (Y4Y) by employing methanol (MeOH) as mediator. A MeOH-mediated self-assembly of Y4Y was undergone at concentrations ranging from 0% to 50% of MeOH, showing that the threshold of self-assembly is 25% for graphene and 20% for MoS₂, with a peptide coverage of ~50% for both (Fig. 1a-b). Higher concentrations of MeOH resulted in no peptide assembly, thus evidencing the effect of MeOH in controlling the coverage of Y4Y structure over both substrates graphene and MoS₂. An additional experiment of post-incubation (PI) was carried out to prove the stability of the assembled structure formed by both initial water-mediated assembly and MeOH-mediated assembly. The figure 1c shows the AFM images of Y4Y before and after PI, demonstrating that after an initial water-mediated incubation, the assembly is easily destroyed in a MeOH-mediated PI. However, when Y4Y is initially incubated with 10%MeOH, the assembled structure remains stable to up 20%MeOH-mediated PI, indicating a distinct formed self-assembled structure. These results unveil promising properties of MeOH as self-assembly mediator on 2D materials.

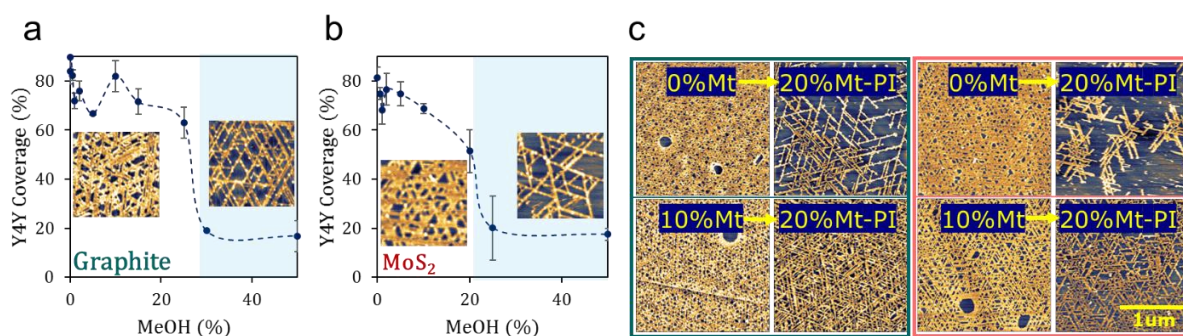


Figure 1. MeOH-mediated control of self-assembly of peptide Y4Y on graphite (a) and MoS₂(b) substrates. c. Stability of self-assembled structures under initial incubation of 0 and 10% MeOH and PI at MeOH 20% for both graphite(left) and MoS₂ substrates(right). Mt: MeOH.

- (1) T. Seki, C. Page, D. Starkebaum, Y. Hayamizu, M. Sarikaya, *Langmuir*, **34**, 1819 (2018).
- (2) P. Li, K. Sakuma, S. Tsuchiya, L. Sun, Y. Hayamizu, *ACS Appl. Mater. Interfaces*, **11**, 20670 (2019).