Polymerization of bispyridylbutadiyne on surface evidenced by STM and application in photocatalysis

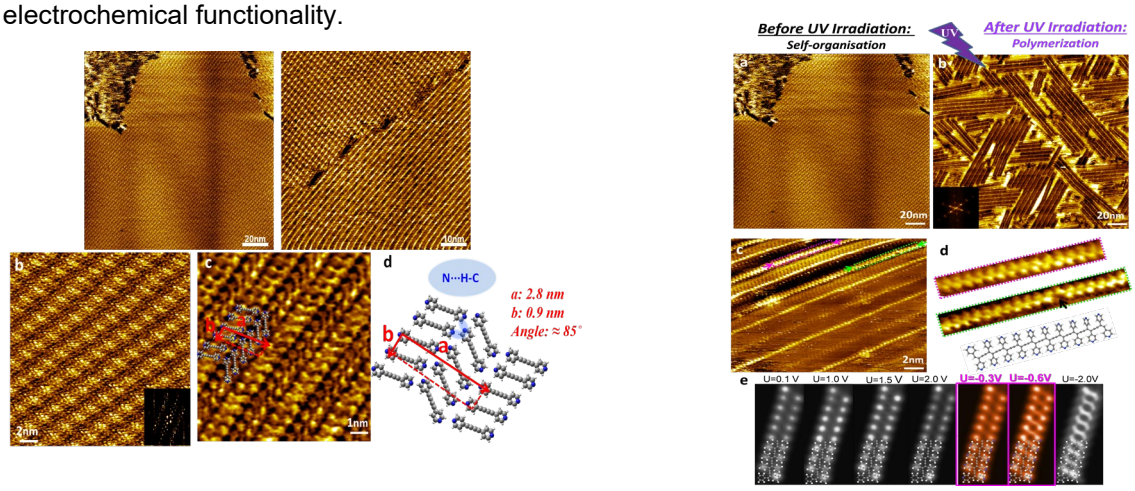
Yan Wu*, Viet-Dung Duong, Ally Aukauloo, Hynd Remita, Jean-Christophe Lacroix and Xiaonan Sun

ITODYS - Université Paris Cité

In this study, scanning tunneling microscopy (STM) was employed to investigate the self-assembly and photo-induced reactivity of BPyB molecules at the 1-heptanoic acid/HOPG interface, providing molecular-level insight into structural evolution relevant to interfacial electron transfer.

Under dark conditions, BPyB molecules (~1.2 nm in length) self-assemble into highly ordered two-dimensional nanostructures with multiple domain orientations and close-packed supramolecular stripe patterns. High-resolution STM imaging reveals a zig-zag molecular arrangement stabilized by intermolecular N···H–N hydrogen bonding and van der Waals interactions with the HOPG substrate. Upon UV irradiation (365 nm), the assemblies undergo pronounced morphological transformations: after 15 minutes of exposure, the structures evolve into one-dimensional polymeric nanowires with lengths ranging from tens to hundreds of nanometers. Sub-molecular resolution STM images reveal the cis-orientation of the pyridine moieties extending from the polymer backbone. Electronic properties of the polymers were further investigated by electrochemical measurements, and their photocatalytic activity was evaluated, demonstrating effective degradation of model pollutants in water. The resulting polymers exhibit promising photocatalytic performance not only for water purification, but also for air treatment and self-cleaning surface applications.

The structural insights provided by STM imaging offer a valuable foundation for understanding and tailoring interfacial electron transfer processes, thereby bridging molecular-level organization with electrochemical functionality.



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