Group: Laboratory of Organic Chemistry: Nanoscale Microscopy and Spectroscopy Group

Project: Unravel Chirality of Single Polymer Chains

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Introduction:

Backbone chirality plays constitutional roles in structures and functionalities of biomacromolecules and synthetic polymers. Helical polymers are comprehensively studied in various research areas, such as molecular biology, polymer chemistry, material science, medicine and optics; because of their diverse functionalities involving recognition, catalysis and circular polarized luminance. How backbone chirality in single polymer chains arises and how it relates to central chirality in monomeric units has remain undisclosed.

Goal:

Unravel chirality of polymers at the nanoscale single-molecule level via advanced surface functionalization and atomic force microscopy (AFM).

The first part of the project consists in functionalizing hydrophilic gold surfaces with thiols to make the gold surface hydrophobic, allowing the deposition of the hydrophobic polymers onto.

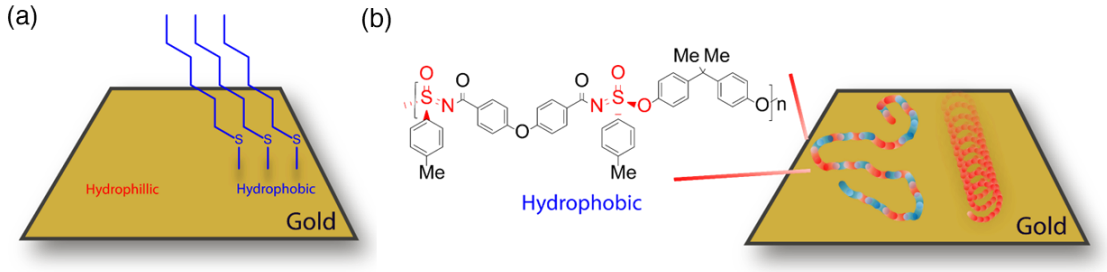

Figure 1: (a) Scheme of hydrophilic and thiol-functionalized hydrophobic gold surface. (b) Scheme of hydrophobic SuFEx polymer on gold surface.

The second part will aim at imaging the ultrastructure of single-polymers chains by high-resolution AFM imaging, in order to unravel their backbone and supramolecular chirality by comparing the morphology of chiral and racemic polymers.

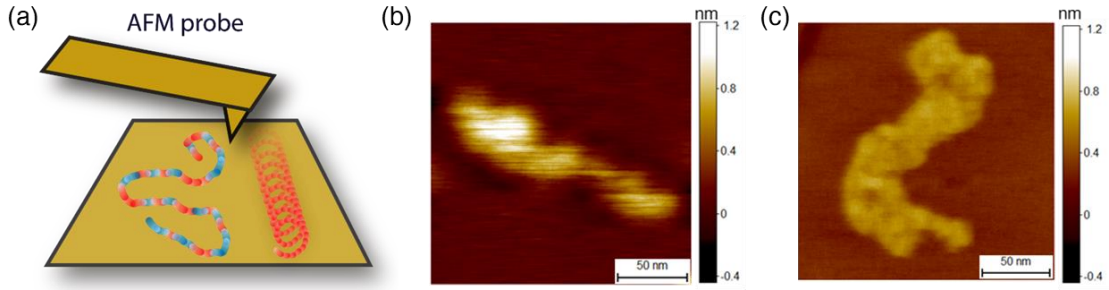

Figure 2: (a) Scheme of AFM with chiral and racemic polymer. (b),(c) High-resolution map of (b) chiral and (c)racemic polymer.

What you will learn:

Advanced Surface Functionalization, High-resolution Single-molecule AFM Imaging, Polymer Analysis.

Reference:

[1] F. S. Ruggeri, B. Mannini, R. Schmid, M. Vendruscolo, T. P. J. Knowles, *Nat. Commun.* ***2020, 11, 2945***.

[2] F. S. Ruggeri, J. Habchi, S. Chia, R. I. Horne, M. Vendruscolo, T. P. J. Knowles, *Nat. Commun.* ***2021, 12, 688***.

[3] D.-D. Liang, S. P. Pujari, M. Subramaniam, M. Besten, H. Zuilhof, *Angew. Chem. Int. Ed.* ***2022, 61, e202116158.***

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