

Characterization of adhesion forces with functionalized polymer substrates

Research framework

During micro-assembly processes, contacts occur between micro assembling tools (like micro-gripper end-effectors) and the manipulated micro-object or between a substrate and a micro-object. The pull-off force, which represents the force required to break a contact, is one of the predominant problems in micro-assembly. This force is directly linked to the surface chemical structure of both the object and the assembling tool and depends on their interaction.

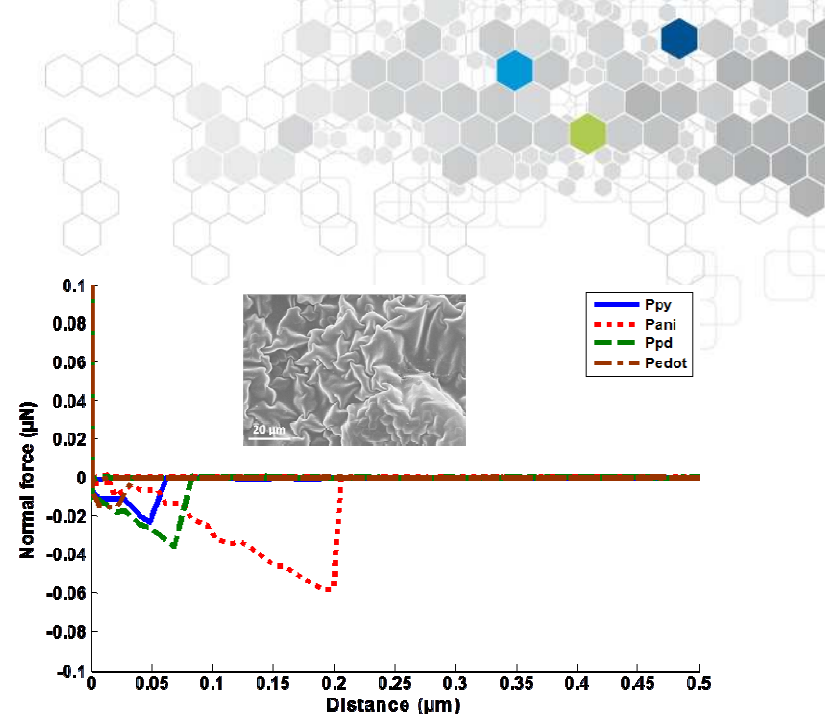
Proposed approach

The use of functionalized surfaces based on **polymer electrodeposition** leads to a **significant reduction of the adhesion force** that were demonstrated by pull-off force measurements. These measurements were performed with the NANOROL robotics platform specifically dedicated to micro-force measurements.

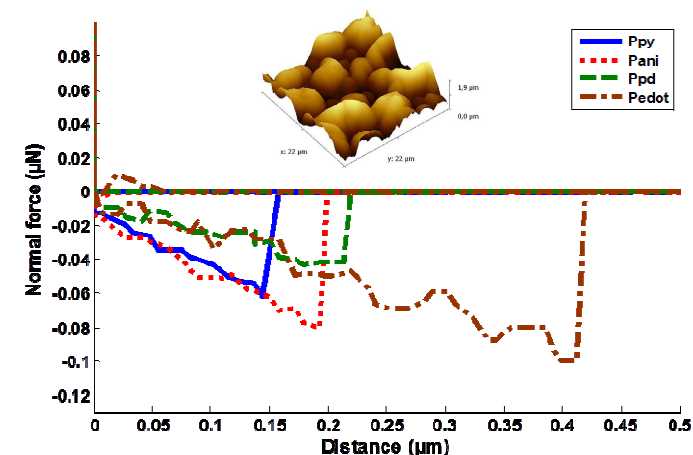
Gold and silicon surfaces were functionalized with 4 different Intrinsically Conducting Polymers (ICPs): polypyrrole, polyaniline, p-phenylenediamine and 3,4-polyethylenedioxythiophene deposited by electropolymerization. The polymer morphological features were also determined by AFM and Scanning Electron Microscopy (SEM) in the aim to correlate both polymer morphologies and polymer chemical structures with their adhesion properties.

Major article: Morphological characterization and analytical application of poly(3,4-Ethylenedioxythiophene)-Prussian Blue composite films electrodeposited in situ on platinum electrode chips. Lupu S., Lakard B., Hihn J.-Y., Dejeu J., Rougeot P., Lallemand S. Thin Solid Films, 2011, 519(22):7754-7762.

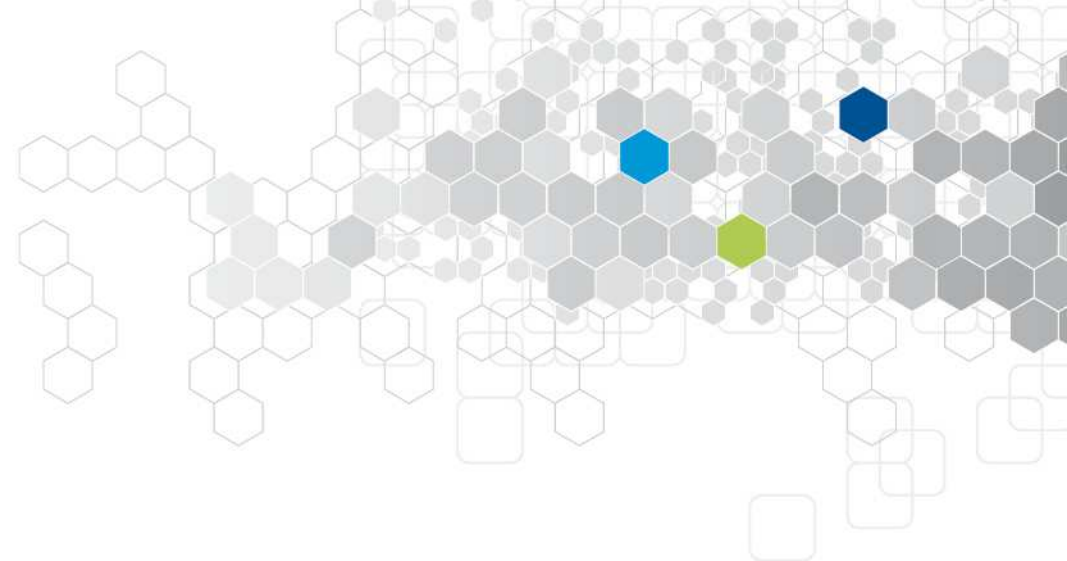
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The force-distance curves by AFM after electropolymerisation for the different intrinsic conducting polymers on **Si** substrates.



The force-distance curves by AFM after electropolymerisation for the different intrinsic conducting polymers on **Au** substrates.



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