# Adhesion Forces Controlled by Chemical Self-Assembly and pH: Application to Robotic Microhandling

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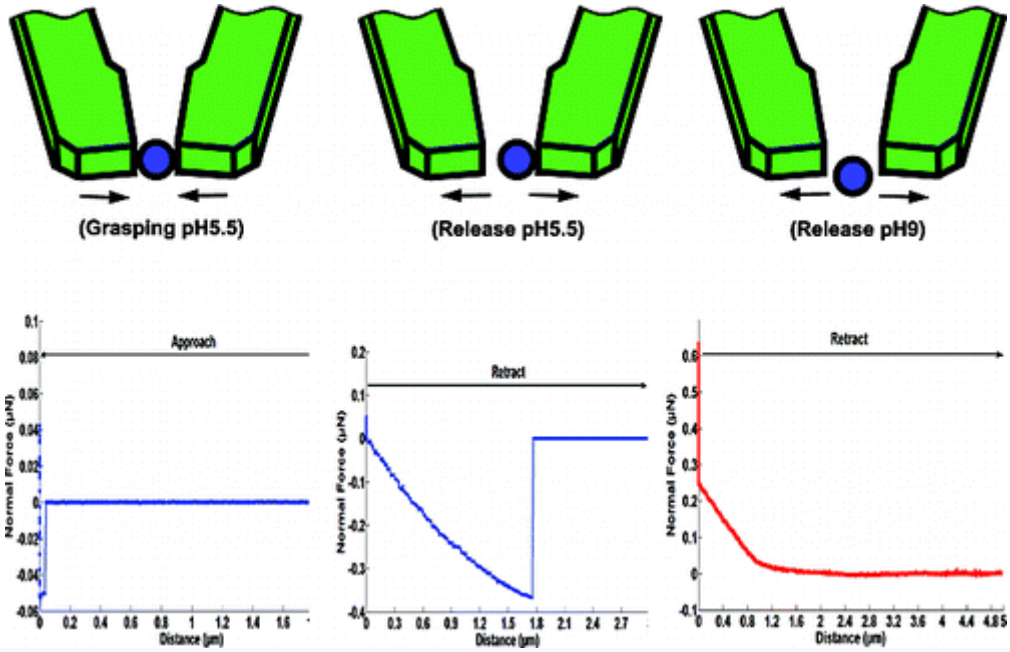
## Abstract




Robotic microhandling is a promising way to assemble microcomponents in order to manufacture a new generation of hybrid microelectromechanical systems. However, at the scale of several micrometers, the adhesion phenomenon highly perturbs the micro-object release and positioning. This phenomenon is directly linked to both the object and the gripper surface chemical composition. We propose to control the adhesion by using a chemical self-assembled monolayer on both surfaces. Different types of chemical functionalization have been tested, and this paper focuses on the presentation of aminosilane-grafted 3-(ethoxydimethylsilyl)propylamine and (3-aminopropyl)triethoxysilane. We show that the liquid pH can be used to modify the adhesion and to switch from an attractive behavior to a repulsive behavior. The pH control can thus be used to increase the adhesion during handling and cancel the adhesion during release. Experiments have shown that the pH control is able to control the release of a micro-object. This paper shows the relevance of a new type of reliable submerged robotic microhandling principle, which is based on adjustment of the chemical properties of the liquid.