

Substrate-guided Photopolymerization of C₆₀ on Calcite

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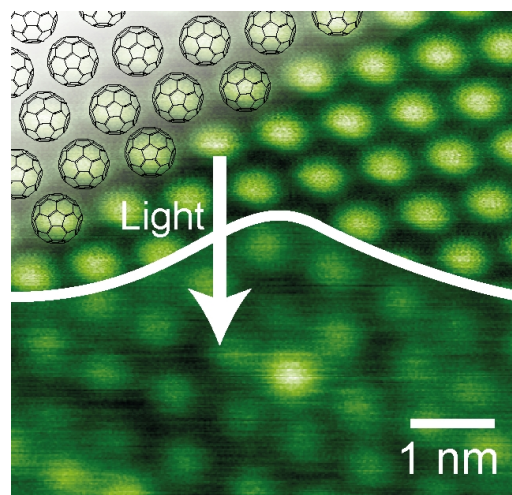
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State-of-the-art surface functionalization technologies are mostly based on top-down methods like lithography, etching and inkjet printing. In order to gain control at the molecular or even atomic scale, bottom-up methods, e.g. molecular self-assembly, have proven to be versatile concepts [1,2], especially for future technologies like molecular electronics.

In order to increase the stability and functionality of self-assembled structures, covalent linking of organic molecules is a most promising approach.

Thermally induced covalent bonding on metallic and insulating substrates has been demonstrated in impressive ways [1,4]. However, the same external stimulus is used for the deposition as well as for the covalent linking of the molecules. To gain control, photochemical linking provides an elegant method to separate the two functionalization steps.

In this study, we induce the [2+2] cycloaddition by irradiation of C₆₀ fullerenes [5]. C₆₀ molecules that are deposited onto the (10.4) cleavage plane of calcite (CaCO₃), form highly-ordered islands, wetting the calcite surface [6]. Upon irradiation with a laser, we induce photopolymerization. We observe a shortening of the intermolecular spacing between reacted species, confirming the successful polymerization of the C₆₀. Most interestingly, the photopolymerization is observed to be guided by the lattice of the underlying substrate. We provide a detailed picture explaining how the lattice dimensions of calcite dictate the formation of well-oriented covalent networks.



References

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