CMCC Mechanochemistry Discussions

Online Seminar Series

Quantitative Studies of Bond Formation Under Applied Force: The Mystery of Two Pericyclic Reactions

THURS. November 19, 2020
at 10:00 AM (CST)

on the CMCC YouTube Channel:
Dr. Adam Braunschweig Seminar

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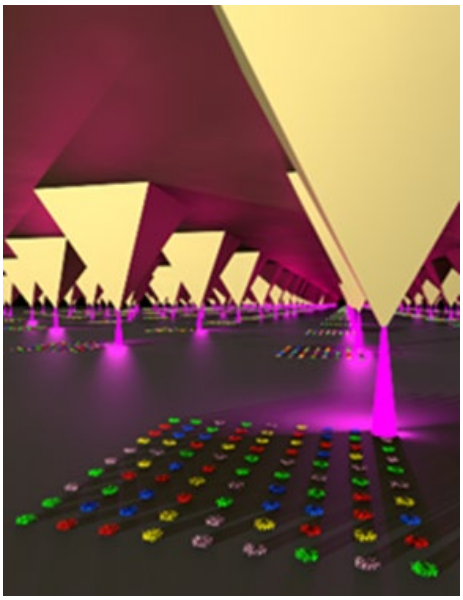
ABSTRACT:
What happens to molecules trapped between interfaces when they smash into each other? How do these tremendous forces distort the molecules and alter their reactivity? Answering these questions could provide organic chemists with new, predictable carbon−carbon bond forming methods that could provide in alternative product selectivities or induce novel and difficult-to-achieve chemical transformations. Organic mechanochemistry—the study of bond formation and rupture under applied force—has focused primarily upon bond-rupture, and very few quantitative studies have been carried out on bond-formation as a consequence of instrumentation-related limitations. Without methods for applying precise, controllable, and directional force between two interacting molecules, mechanochemical bond-formation will remain phenomenological and resist the predictability needed for chemists to accept it as a viable synthetic strategy. This lecture will describe efforts from the Braunschweig Group to develop a set of tools for quantifying bond-forming reactions in organic monolayers. Studies on two classical pericyclic reactions—the [3+2] Huisgen dipolar cycloaddition and the [4+2] Diels-Alder reaction—under mechanical activation and on surfaces will be described. The major results of this work are a new quantitative understanding of the role of force on bond-forming pericyclic reactions and the first reported method to covalently pattern the graphene basal plane. The characterization of bond-forming on surfaces is a general problem that remains unaddressed, and work will also be presented that shows the potential of surface chemistry when chemistry, instrumentation, and characterization are considered as equally important aspects of reaction design.



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