Kansas State University

Title:
Responsive organic solid-state materials achieved through self-assembly and crystalline-state chemical transformations

Abstract:
Chemical transformations conducted in the crystalline phase are significantly less common than solution-based reactions, primarily due to reduced motion, flexibility, and overall reactivity. In crystalline-state transformations, reactants can be designed to self-assemble into specific spatial arrangements, often leading to high control over product regiochemistry and/or stereochemistry. In such crystalline transformations, typically only one type of reaction occurs, and a sacrificial template molecule is frequently used to facilitate self-assembly, similar to a catalyst or enzyme. Here, we describe the first system designed to undergo two chemically unique and orthogonal cycloaddition reactions simultaneously within a single crystalline solid. Using well-controlled supramolecular self-assembly, orthogonal reactivity is achieved without requiring a sacrificial template. We will also discuss the application of dually-reactive systems toward (supra)molecular solar thermal storage materials. Lastly, we will describe recent efforts toward the programmable functionalization of dienes via solid-state structural control and wavelength-selective photocycloadditions.