Borane Lewis Acids: From Molecules to Materials

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Abstract

The incorporation of main group elements into conjugated materials is known to result in unusual properties and to enable new functions.[1] The ability of tricoordinate boron to participate in pi-delocalization can have a dramatic effect on the optical properties by selectively lowering the LUMO orbital levels. The electron-deficient character of boron also enables Lewis acid-base interactions, resulting in strong perturbations of the electronic structure. These materials have been studied for applications ranging from biological imaging, lasing, organic photovoltaics, to photochromic materials and molecular switches.

In our recent work, we have explored the effects of boron incorporation into conjugated oligomers, macrocycles, and polymers.[2] We have also demonstrated that base-directed electrophilic aromatic C-H borylation provides an effective means to generate luminescent B-N containing conjugated materials with unusual properties such as self-sensitized singlet oxygen generation.[3] Finally, we have found that "smart" dynamic materials can be achieved by embedding both Lewis acid and base sites into polymer networks.[4]

In this talk I will discuss these discoveries and highlight their impact in applications ranging from luminescent materials, sensors, solar cells to dynamic polymer network materials.

Keywords: conjugated materials; luminescent materials; transient polymer networks

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Biography

Frieder Jäkle is a Distinguished Professor in the Department of Chemistry at the Newark Campus of Rutgers University. He received his Diploma in 1994 and Ph.D. in 1997 from TU München, Germany, under the direction of Prof. Wagner. After a postdoctoral stint with Prof. Manners at the University of Toronto he joined Rutgers University in 2000. His research interests revolve around main group chemistry as applied to materials and catalysis, encompassing projects on organoborane Lewis acids, conjugated hybrid materials, luminescent materials for optoelectronic and sensory applications, stimuli-responsive and supramolecular polymers. He is the recipient of an NSF CAREER award (2004), an Alfred P. Sloan fellowship (2006), a *Friedrich Wilhelm Bessel Award* of the Alexander von Humboldt Foundation (2009), the ACS Akron Section Award (2012), the Boron Americas Award (2012) and the Board of Trustees Research Award at Rutgers University (2017). In 2019 he was named a *Fellow* of the American Chemical Society. He has served on the editorial advisory boards of several journals, including Macromolecules, ACS Macro Letters, and Organometallics.