Molecular Engineering of Crystalline Nano-optomechanical Transducers

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\textbf{Abstract}

Crystalline materials that behave as optical actuators and proceed via some form of nano-optomechanical mechanism are of particular interest for optical data storage\textsuperscript{[1]} or quantum computing\textsuperscript{[2]}. Nonetheless, the field is facing a dearth of suitable functional materials for applications. One possible material option is a series of compounds based on the generic formula, $[\text{Ru(SO}_2\text{)}(\text{NH}_3)_4\text{X}]\text{Y}$, whose SO$_2$ group manifests solid-state linkage photo-isomerization (X is the trans-ligand to SO$_2$; Y is a counterion). This light-induced phenomenon causes these materials to act as photo-induced molecular switches \textsuperscript{[3-5]} or molecular transducers \textsuperscript{[6,7]} whose nano-optomechanical properties exist in the single-crystal state: a high-quality solid-state medium for single-photon control.

This talk will present the development of this family of materials towards such applications, via a range of advanced in situ 'photo-crystallography' and in-situ imaging experiments that capture the phenomenon in their light-induced state \textsuperscript{[8-10]}. Results are enabling our understanding of the light-induced molecular structure and nano-optomechanical properties of these light-induced solid-state actuators. Establishing this knowledge-base of structure-to-function relationships leads to the ultimate goal of being able to molecularly engineer these materials for a given device application.

\textbf{References}


