

# Nanoscale Photocatalysts Derived from Layered Phases

## Formation and Characterization

Eric J. Nichols, Scott T. Misture

Alfred University

Layered Aurivillius phases have in the past been shown to be photochemically active for hydrogen production, water purification, and similar applications. These phases consist of perovskite-like blocks sandwiched between  $[\text{Bi}_2\text{O}_2]^{2+}$  layers, which can be selectively removed via an acid leaching procedure. This allows for the formation of high surface area photocatalysts with grain sizes in the nanometer range. Cationic substitutions on the perovskite A sites allow for the manipulation of the band gap of these materials and potential red-shifting of the band gap into the visible light region. Systematic manipulation of the local environments surrounding the  $\text{TiO}_6$  and  $\text{NbO}_6$  octahedra will be discussed in regards to photocatalytic & band gap engineering.

$\text{K}_4\text{Nb}_6\text{O}_{17}$ , another type of layered structure, has been previously demonstrated to be a viable UV-sensitive photocatalyst for use in water splitting applications. For this study,  $\text{K}_4\text{Nb}_6\text{O}_{17}$  has been synthesized via solid state reaction of the stoichiometric mixture of the precursor materials  $\text{Nb}_2\text{O}_5$  and  $\text{K}_2\text{CO}_3$ . The proton exchanged form ( $\text{K}_x\text{H}_{(4-x)}\text{Nb}_6\text{O}_{17}$ ) of the material was subsequently produced and reacted with TBAOH to form chemically-exfoliated sheets. Following titration with HCl, the scrolled form of  $\text{K}_x\text{H}_{(4-x)}\text{Nb}_6\text{O}_{17}$  was created and analyzed using *in-situ* x-ray diffraction to show the conversion to nanotubes on heating.