**Department of Materials Science and Engineering,**

**Ph.D. Candidacy Examination**

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# Tantalum oxynitride: Impact of synthesis on the properties of a photoactive heteroanionic material

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## Abstract

Heteroanionic materials, or materials containing two or more anionic species in a single phase, offer new opportunities for control of property and structure because of differing anion characteristics. Oxy-anion materials (e.g., oxynitrides, oxyfluorides, oxysulfides) are examples of heteroanionic materials that are being widely researched owing to their tunable optical and electronic properties. Tantalum oxynitride (TaON) is an important example of an oxynitride material that showcases the photoelectrochemical stability of an oxide ($Ta_2O_5$) with the desired band energies of a nitride ($Ta_3N_5$). Depending on the synthesis technique, the conduction and the valence band positions of TaON can also be fine-tuned to obtain optimized band energies for a myriad of photocatalytic reactions. Synthesis conditions also highly impact TaON physical properties and morphology and enable access to different metastable phases (or structures) of TaON, which have been shown to exhibit enhanced photoactivity. This talk will introduce heteroanionic materials, with a focus on TaON, and the intimate connection between TaON synthesis and properties that have promoted its application as a promising photocatalytic material.