Synthesis of Ta$_2$O$_5$ by Anodization and TaON by Nitridation and their Characterization

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ABSTRACT

Tantalum oxide (Ta$_2$O$_5$) was synthesized by an anodization method, and single phase tantalum oxynitride (TaON) was prepared by a novel nitridation method developed in our lab. SEM images of the sample surfaces have been obtained. The synthesized samples were further characterized using X-ray diffraction (XRD) and UV-vis absorbance. The novel nitridation approach reproducibly yields single phase TaON. Preliminary studies on the oxide using chronoamperometry (j/t), linear sweep voltammetry (LSV), and electron impedance spectroscopy (EIS) have been performed. Comparison of the Ta$_2$O$_5$ and TaON are in progress.

INTRODUCTION

- Anodization of Ta foil is a approach to synthesize 1-D Ta$_2$O$_5$ nanotubes
- However, Ta$_2$O$_5$ is active only under UV radiation (large bandgap 3.9 eV, < 5% UV content in solar spectrum)
- Nitridation of Ta$_2$O$_5$ can be used to synthesize its nitrogen derivatives with lowered bandgap allowing for utilization of wider solar spectrum
- Our aim is to make TaON nanotubes using a simplified nitridation method recently devised in our lab.

METHODS

- Anodization of Ta foil is a approach to synthesize 1-D Ta$_2$O$_5$ nanotubes
- Nitridation of Ta$_2$O$_5$ can be used to synthesize its nitrogen derivatives with lowered bandgap allowing for utilization of wider solar spectrum
- SEM can be used to observe surface topography of the sample.
- The morphology of surface has changed after nitridation.

APPLICATION

- Anodization of Ta was observed to yield Ta$_2$O$_5$ phase
- TaON was synthesized by simplified nitridation of Ta$_2$O$_5$
- 3-fold increment in photocurrent was observed.

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REFERENCES