**Effect of Sulfated Titania on Photocatalytic Degradation of Methyl Orange:**

**Sulfated vs Sulfur Free, Effect of Calcination**

Section 1: Intro

Section 2: Experimental

Source of Materials

ICP Determination of Sulfur Content

XRD

Particle Size Distributions

Specific Surface Area and Porosity

Description of Reactors

Characterization of Light Sources (LED intensity vs forward current)

Wavelength Dependence Spectral Distribution

Power Supply Circuit Diagram

Section 3: Results

* 3.1. Kinetics of Methyl Orange Degradation

3.1.1. Tungsten Lamp Data

Mass Dependence: Initial Rate vs Mass

USR AR, USR 450, BC AR, BC 400, P25, AA

Any correlation between sulfur content and optimal rate (plateau)

Rate Order

Particle Size Effects

3.1.2. UV LEDs at Different Wavelengths

Mass Dependence

Photon Dependence

Rate Order

Particle Size Dependence

Flux Dependence

3.2. Photocatalyst Characterization

Band Gap

Position of VB (Alignment) from XPS

Absorbance to Quantify Photon Capture at Particular Wavelength

* Band Gaps (UV-Vis) and Position of Band Gap (XPS)
* Phase (XRD)
* Chemical Composition (ICP + OES)
* Surface Area and Pore Size Distribution (BET)
* Attenuation Length as a Function of Wavelength from dielectric function

Figures:

* Initial Rate vs Mass for both As Received and 450C Calcined and Exposed BC and P25
* Initial Rate vs Wavelength for both As Received and 450C Calcined and Exposed BC and P25

Section 4: Discussion

Does the Rate Depend on the Catalysts Integrated Ability to Absorb the Photons

Relation between Rate and Surface Area

Relation of XAFS Data and Rate (Intensity of Pre Edge Feature)

Broadening of Band Gap with Sulfur content – Separated Tetrahedra are predicted to broaden the bad gap.

Is the band gap in AR BC due to present of titanium vacancies

How does band alignment effect the reactions that produce radicals (superoxide, hydroxyl, hole driven, electron driven).

Analysis of Coupled Differential Equations and Order to Explain Reactions (low mass and high mass)

To do:

ICP Analysis of new Sigma Aldrich, New USR

XPS on new USR AR and USR 450

* Mass Dependence of Low Sulfur Sigma Aldrich

Particle Size Distribution of New USR and USR 450

Dynamic Light Scattering (DLS)

Adjust pH and Remeasure BC, BC 400, BC BET

Dilute USR and AA even more and remeasure spectra

Purging Oxygen Experiment