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Salophen Sol-Gel Hybrid Material for the Aqueous Sensing of Actinyl Ions

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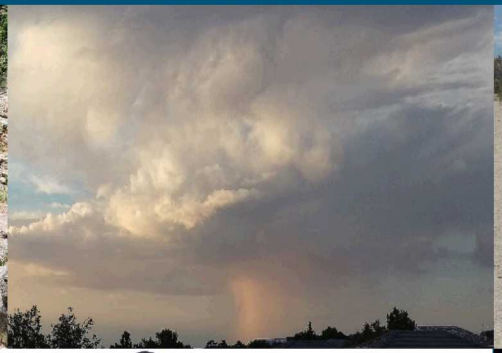
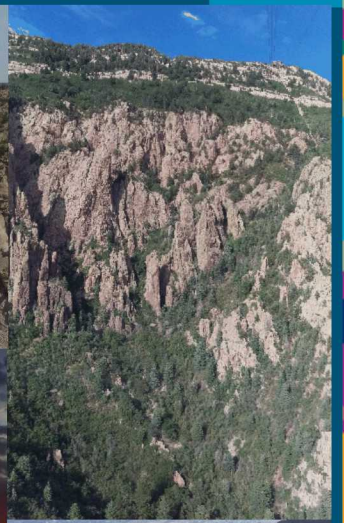
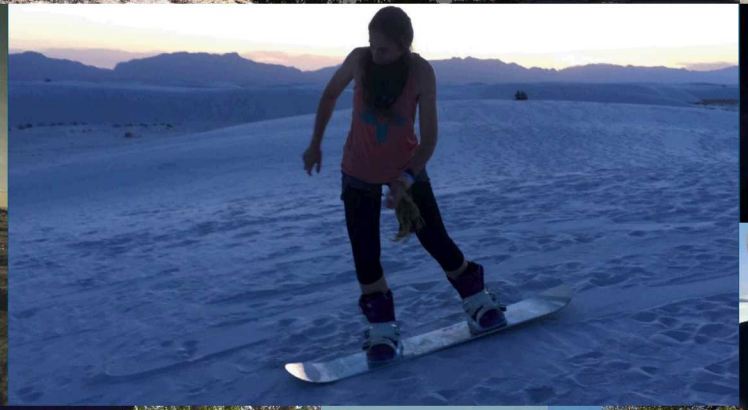
Summer Fun in New Mexico!







Jaclynn Unangst (Org. 1874)

- Educational Background
  - BS Chemistry 2009, University of Arizona in Tucson, AZ
  - MS/PhD Candidate, Exp. Fall 2018, University of California, Irvine in Orange County, CA
- Division: Research & Development
  - Nanoscale Sciences Department
  - Dr. Tina Nenoff (Senior Scientist)
  - Dr. Carlos Gutierrez (Manager)

- Research
  - Sol-Gel Salophen Thin Film Sensors for the Detection of Actinyl Ions
  - Sol-Gel Salophen Hybrid Materials for the Aqueous Sequestration of Actinyl Ions

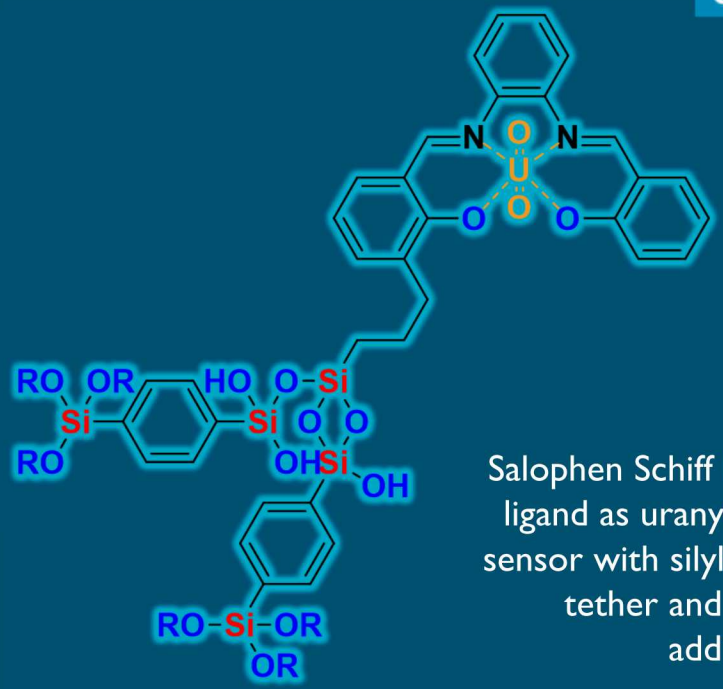
Research Overview and Motivation

Sensing of Radioactive Material

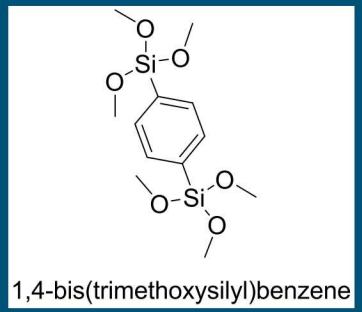
- Important for national security, human and environmental safety and ensuring a safe and reliable future of nuclear energy
- Can be accomplished through a **salophen Schiff base** optical sensor designed for aqueous uptake of uranium, neptunium and plutonium

Salophen Schiff Base

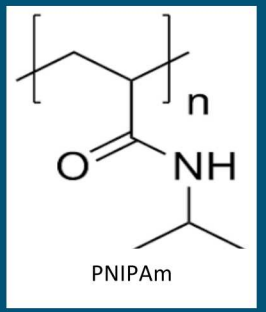
- Has demonstrated ability to chelate U and Np ions during solvent extraction, detectable via UV-Vis spectroscopy[1]
- Can be chemically modified with a 3-(triethoxysilyl)propyl tether for covalent anchoring while maintaining rotational freedom[2]
- 1,4-bis(trimethoxysilyl)benzene ((Ph)BPS) and poly(N-isopropylacrylamide) (PNIPAm) may increase sensor porosity and facilitate ion transport and chelation[3]



Salophen Schiff base ligand as uranyl ion sensor with silylated tether and BPS addition



1,4-bis(trimethoxysilyl)benzene

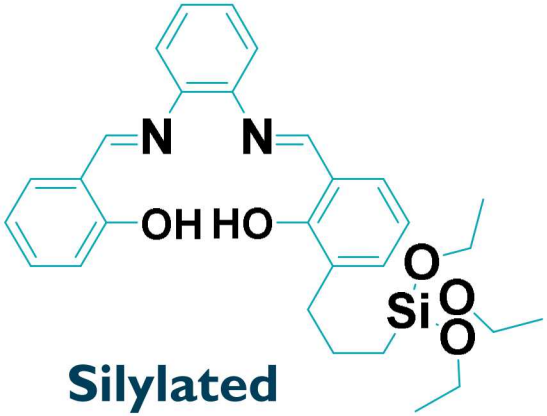


PNIPAm

1. Hawkins, C. H. *et al. Dalton Trans.*, 2016, 45, 15415–15426
2. Unangst, J. L. *et al. In preparation*
3. Lionel, N. *et al. Chem. Commun.*, 2004, 2312-2313 4. Du, B. *et al. Langmuir* 2009 25(20), 12367-12373

Research Approach

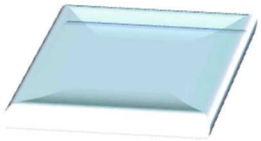
A)



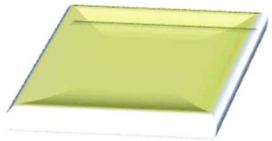
Silylated Salophen

Sol-Gel Monomers
Template Polymer

+



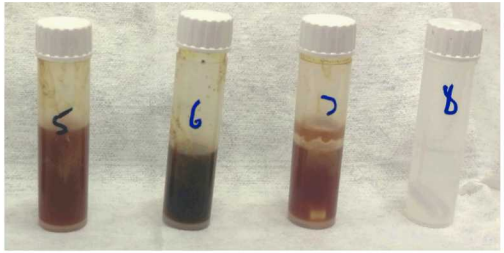
Solvent



Glass Substrate

Actinyl Ion Sensor

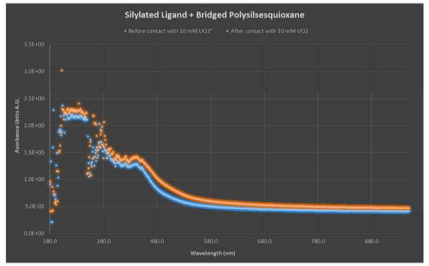
B)



C)

D)

E)



A) Schematic of sensor formation B) Sensor solutions prior to spin coating, dip coating or electrospray deposition C) Sensor after coating on glass substrate D) Sensor in contact with UO_2^{2+} solution E) UV-Vis of solid sensor

Summary of Results of Actinyl Ion Thin Film Sensors

- Through different sensor formulations, a UV-Vis red shift to >460 nm has appeared for thin film sensors containing silylated salophen with:
  - PNIPAm or (Ph)BPS
  - Non-heat treated silylated salophen
  - Electrosprayed silylated salophen
- Future work includes kinetic studies, detection limits and FTIR confirmation