

Technetium Chemistry : CHEM 793-1010 Spring 2017

Instructor: Dr. Eswari Balasekaran and Pr. Frederic Poineau
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Time & Location

Tuesday, 9:00 AM– 12:00 PM
MSM 112 Lecture / MSM 173 Laboratory

Grading

Exam (70%): oral presentations (~20 min, presentation of articles given by the instructors)

Participation (30 %)

Textbook

Technetium: Chemistry and Radiopharmaceutical Applications by Schwochau, K. Wiley-VCH: Weinheim, Germany, 2000.

Note: the book will be provided in .pdf format by the instructors.

The goal of the class is to provide students with fundamental and applied chemistry of technetium and combine lectures in class with laboratory sessions. Presentations are given on the redox, coordination and synthetic chemistry of technetium complexes in all the oxidation states. The class will also focus on the application of technetium in nuclear medicine.

The lectures in classes are based on the book *Technetium: Chemistry and Radiopharmaceutical Applications*. The lectures cover:

Introduction: discovery, isotopes and application of Tc
Analytical chemistry: identification, determination, and separation methods
Synthetic and coordination chemistry: compounds and structure
Redox chemistry: oxidation states and redox properties
Solution chemistry: Eh-pH diagram, speciation, complexation
Technetium chemistry in the fuel cycle
Medical uses: ^{99m}Tc , radiopharmaceuticals and radioactive tracers

The laboratory classes will occur in March and April; the laboratory component focuses on developing hands-on experience with radioactive materials, handling and technetium-specific laboratory techniques. The laboratory classes cover: Preparation and characterization of ^{99}Tc compounds in the oxidation states +3 to +7. The laboratory component consists of 7 classes:

- Class 1: handling of technetium
- Class 2: preparation of KTcO_4
- Class 3: preparation of K_2TcCl_6
- Class 4: preparation of $(n\text{-Bu}_4\text{N})\text{TcO}_4$
- Class 5: preparation of $(n\text{-Bu}_4\text{N})\text{TcOCl}_4$
- Class 6: preparation of $\text{TcCl}_3(\text{PPh}_3)_3 \cdot \text{CH}_3\text{CN}$
- Class 7: preparation of $(n\text{-Bu}_4\text{N})\text{TcNCl}_4$

In those laboratory classes, students will work in the radiochemistry laboratories at the HRC under the supervision of Pr. Poineau and Dr. Balasekaran. Prior the classes, students will be required to complete the radioprotection and protocols trainings and perform bioassay prior and after the completion of the classes.

Couse Outcomes

- Understand the role of oxidation-reduction reactions in technetium chemistry
- Ability to discuss the synthetic and coordination chemistry of technetium
- Understand the role of 4d electron in bonding and properties of technetium complexes
- Explain the applications of technetium
- Ability to work with technetium (^{99}Tc) in solution and in the solid-state
- Ability to perform the preparation of technetium complexes

CHEM 793-1010 Technetium Chemistry Course Schedule

Wk	Date	Instructor	Lecture #	Topics *
1	01/17/17	SMB	1	Instruction for the class
2	01/24/17	SMB	2	Discovery, occurrence, isotopes of Technetium
3	01/31/17	SMB	3	Fundamentals and analytical Chemistry of Technetium
4	02/07/17	SMB	4	Synthetic and coordination chemistry: Oxidation state +7 to +3
5	02/14/17	SMB	5	Synthetic and coordination chemistry: Oxidation state +3 to -1
6	02/21/17	SMB	6	Redox and Solution Chemistry
7	02/28/17	SMB	7	Technetium Chemistry in fuel Cycle
8	03/07/17	SMB	8	^{99m} Tc radiopharmaceutical applications
9	03/14/17	SMB	Tc Lab 1	Lab protocol training
10	03/21/17	SMB/FP	Tc Lab 2	Synthesis of K[TcO ₄]
11	03/28/17			SPRING BREAK
12	04/04/17	SMB/FP	Tc Lab 3	Synthesis of K ₂ [TcCl ₆]
13	04/11/17	SMB/FP	Tc Lab 4	Synthesis of <i>n</i> -NBu ₄ [TcO ₄]
14	04/18/17	SMB/FP	Tc Lab 5	Synthesis of <i>n</i> -NBu ₄ [TcOCl ₄]
15	04/25/17	SMB/FP	Tc Lab 6	Synthesis of <i>n</i> -NBu ₄ [TcNCl ₄]
16	05/02/17	SMB	Tc Lab 7	Synthesis of TcCl ₃ (PPh ₃) ₃ ·CH ₃ CN
17	05/09/17	SMB	9	EXAM