

CHEM-E4101

Lab Work in Inorganic Chemistry, 5 cr

Eeva-Leena Rautama



Aalto University
School of Chemical
Engineering

Briefly on the course

- **First time in Period I**
 - CHEM-E4130 Chemistry of the Elements is the corresponding theory course and CHEM-E4120 Quantitative Instrumental Analysis contains supporting information as well
- **Three lab works, max. three persons in a group**
- **Materials: mainly provided by teacher(s)**
- **Must do:**
 - presence in all necessary lab sessions (five *per* student),
 - submission of individual digi-exercises (from two works)
 - one full scientific report in English (from one work)
- **Grade: fail/1-5 (exercises and report)**

Learning outcomes

After completing the course, you will

- gain a deepened understanding of the chemistry of elements
- familiarize yourself with basic concepts of systematic inorganic materials design
- perform hands-on measurements with laboratory/research instruments
- demonstrate advanced data interpretation and reporting

Workload

5 cr = 135 h

Contact teaching at the lab: ~25 h

Preparation for the lab: 25 h (5 h + 10 h + 10 h), includes processing time. Includes exercises and work instructions

Post-lab preparation of exercises: 20 h (10 h + 10 h)

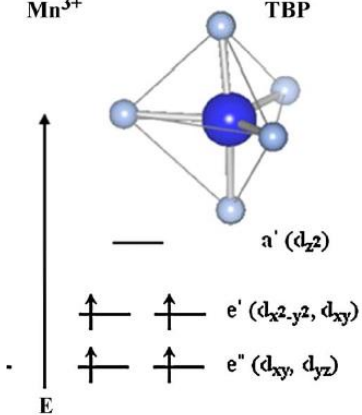
Lab report: 65 h (data analysis and summary session included)

The laboratory works

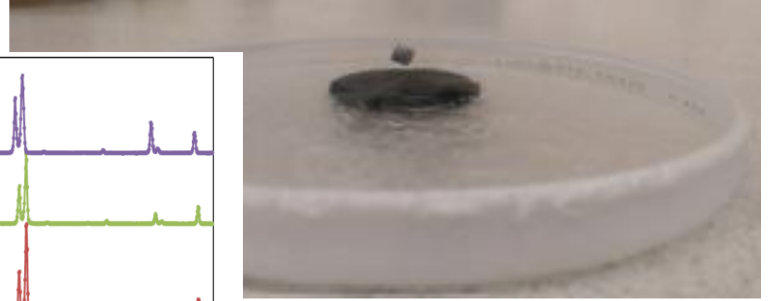
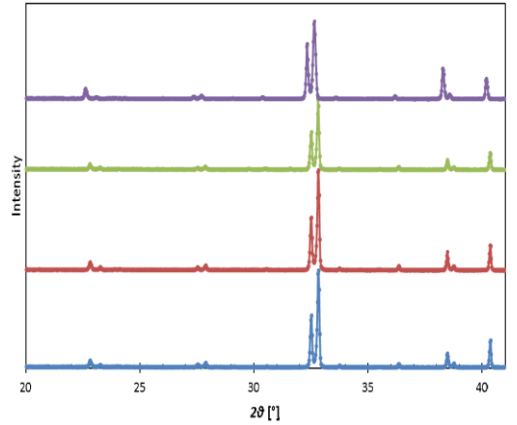
Ultramarine pigment $\text{Y}(\text{In},\text{Mn})\text{O}_3$



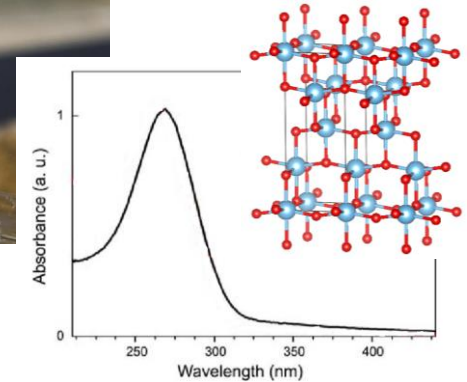
Mn^{3+} TBP



High-temperature superconductor $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$



Photoactive TiO_2 surfaces by spin-coating



Activities in the lab

Synthesis methods: Solid state and sol-gel precursors, high-temperature synthesis

Analyses: Powder X-ray diffraction (XRD), UV-Vis spectrometry for solid materials, X-ray fluorescence (XRF), thermogravimetry (TG), RedOx titrations under inert conditions

Handling of gases and cold liquids

Grading

- **Elements: Pre- and postwork from all three lab topics: 100 points**
- **Purpose: to familiarize you into the topic and summarize the theoretical essence behind the practicals. The exercises are mostly based on the previous and ongoing studies**
- **Work #1: $\text{YBa}_2\text{Cu}_3\text{O}_7$ (“YBCO”) superconductor: most extensive => lab report. Practice on scientific writing and reporting (in English), idea is to present the work done similar to a journal paper.**
 - Self-made graphs, i.e. “figures”
 - Informative content: presenting analysed data, data comparison
 - Emphasis on the essential content, not in “reporting”
 - 45 % of the grade (prework 5 %, compulsory) = 50 points



Grading –cont.

- **Works #2 and #3: 25 % each (pre- and postwork total).
Variations in questions**
- **Work #2: Synthesis and characterization of the ultramarine pigment $Y(\text{In}_{0.9}\text{Mn}_{0.1})\text{O}_3$**
 - solid solution (substitution), reasons behind the colors in solid state
 - Exercises 25+5 points (1 bonus question)
- **Work #3: phase-controlled TiO_2 -film deposition**
 - Organometallic precursors for inorganic synthesis
 - Polymorphism and thin-film deposition
 - Exercises 25 points

