CHEM-4101

Lab Work in Inorganic Chemistry, 5 cr

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Info session at 13.15

Aalto University
School of Chemical
Engineering

Briefly on the course

- **New course, organized for the first time as such in the Period II**
  - CHEM-E4130 Chemistry of the Elements is the corresponding theory course
- **This fall: 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 pre- and post-lab reply forms (from two works, short ones)
  - one full scientific report in English (from one work)
- **Grade: fail/1-5 (preparative questions 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: ~20 h

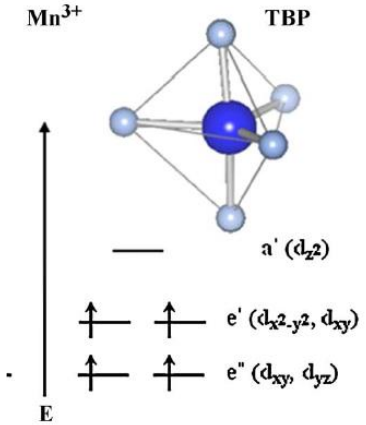
Preparation for the lab: 25 h (5 h + 10 h + 10 h), includes processing time. Exercises and work instructions

Post-lab preparation of exercises: 20 h

Lab report: 70 h (data analysis and presentation included)

The laboratory works

Ultramarine pigment $Y(In,Mn)O_3$



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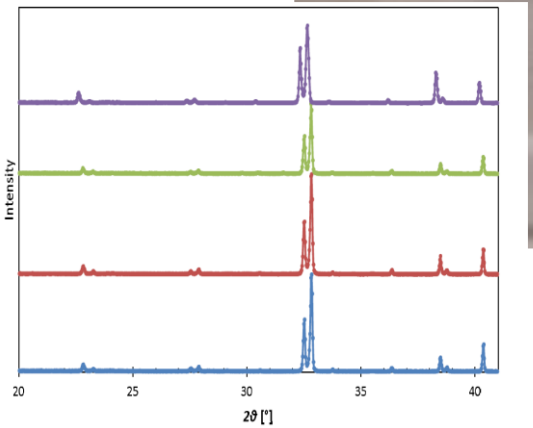
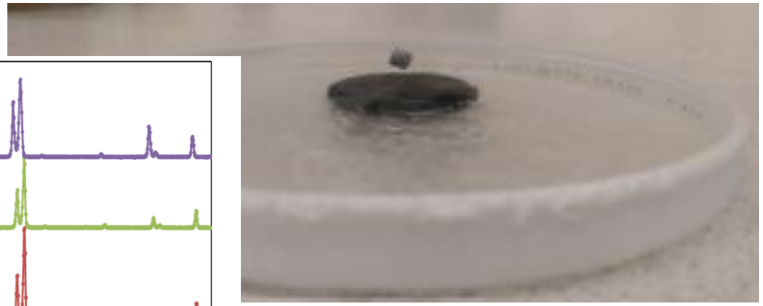
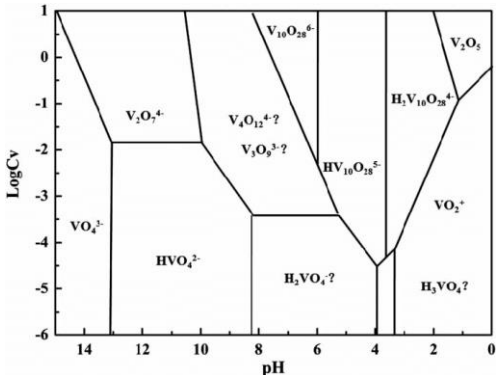
High-temperature superconductor $YBa_2Cu_3O_{7-\delta}$





Vanadium RedOx chemistry in aqueous solutions



Activities in the lab

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

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

Handling of special 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 studies**
- **Work #1: $YBa_2Cu_3O_7$ ("YBCO") superconductor: most extensive => lab report. Practice on scientific writing and reporting (in English), idea is to present the work done like 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

See the rubric (evaluation matrix) from the course material folder

Grading –cont.

- **Works #2 and #3: 25 % each (pre- and postwork total). Variations in questions**
- **Work #2: Synthesis and characterization of the ultramarine pigment $Y(In_{0.9}Mn_{0.1})O_3$**
  - Understanding the phases, solid solution (substitution), reasons behind the colors in solid state
  - Exercises 25+5 points (1 bonus question)
- **Work #3: exploring RedOx behavior of aqueous vanadium**
  - Reasons behind the ions and their colors in an aqueous state, RedOx behavior and differences in it
  - Supported by the Work #2
  - Exercises 25 points