



## Synthesis methods and structural synthesis of the new compounds

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### Course description:

In today's world, new technologies are based on new materials (unique chemical compounds) which are often unseen and unappreciated. It is evident that without the development and discovery of new materials, technology would not continue to grow.

The lecture will give an overview of the synthesis methods widely used in the solid state laboratories. First part will describe techniques typical for polycrystalline sample preparation such as arc-melting and solid state reaction method. The second part will focus on crystal growth methods, in particular the molten flux and vapor transport. I will discuss advantages and disadvantages of each technique and refer to the literature to point out the examples of the materials in which a special technique must be used. Case studies will be given to emphasize the importance of good equipment, experience of the scientist and... some luck.

The third part of the lecture will discuss modern structural characterization techniques. I will begin with a very simple but the most often used: x-ray powder diffraction method. Then will describe related techniques: neutron powder diffraction and triple axis x-ray diffractometry. Special attention will be given on the refinement packages: GSAS and FullProf, which are very powerful and widely used to refine x-ray or neutron diffraction pattern. In my opinion, it is essential for a Postdoctoral Fellow, in the field of material science, to be familiar with one of these tools. I will give an example of a new and a very complex  $Mg_{10}Ir_9Bi_6$  compound, which crystal structure characterization was possible by using various techniques including Convergent Beam Electron Diffraction (CBED), High Resolution Electron Microscopy (HREM), Electron Probe Micro-Analyzer (EPMA).

The subject of the lecture will also include the techniques of encapsulation and sample characterization of the transuranium materials. Preparation of actinide compounds requires more attention due to technical difficulties and limited quantities of the material which can be used in the synthesis process.

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