Dlaczego warto polubić Optical Floating Zone?

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Single crystals of oxides fascinated humanity since the beginning of history. The recently acquired ability to create new, complex crystals of oxides and their solid solutions opened the door for investigating and modification the basic physical properties of materials leading to new applications.

In my talk - when paying attention to the history of growing crystals of oxides - I would like to stress the value of search for new materials leading to modification of optical, magnetic, thermal, piezoelectric and electrical properties of crystals.

Each crystal growth technique (with its specific thermal and mechanical design) offers limited adaptability to the material requirements. As the result, some techniques are more suitable for particular groups of materials. Understanding phase diagrams – and creating new ones - is necessary for success. Modeling can be a great help in optimizing apparatus design and process parameters so it is widely use in industrial application - however it is a very labor intensive approach, difficult to apply in the university environment.

I will discuss the effects of growth conditions and starting composition on crystal properties of different oxides. I will make an effort to show how a niche method like Optical Floating Zone [OFZ] may complement the well established methods like Czochralski or Bridgman in producing single crystals of exotic oxides.

As examples of those relatively exotic oxides and their solid solutions I will discuss congruently melting, cubic, rare earth pyrochlores $RE_2M_2O_7$ (where RE is a rare earth element and M is either Ti, Sn, V, Hf or Zr), hosting many unusual, magnetic, frustrated states which – together with the perovskite family - in recent years are in the center of attention of solid state physics. Another presented examples are incongruently melting high temperature superconducting oxides $Bi_2Sr_2Ca_{n-1}Cu_nO_{4+2n+x}$ and Ba or Sr doped $LaCu_2O_4$.

Using OFZ method and modifying the growth conditions it is possible to grow relatively big, high quality crystals of solid solutions of those promising materials.

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