GraFOx in a nutshell

Long-term materials strategy

In its first phase from 2016 to 2020, the network has focused on the sesquioxides Ga_2O_3, In_2O_3, Al_2O_3, with some initial work on the more complex and versatile class of perovskites, e.g. $SrTiO_2$, $LaAlO_3$, $BaSnO_3$. On a midterm timescale, we expect to gain comprehensive knowledge of both material systems. We expect that lessons learned from the work on sesquioxides will greatly facilitate achieving high material quality and understanding of complex oxides. This will eventually unite these presently distinct research fields.

Overall goals of GraFOx

- to achieve material with high crystalline perfection sesquioxides (Ga_2O_3, In_2O_3, Al_2O_3) in a first stage and later also of complex oxides (of the type $SrTiO_3$)
- to understand fundamental material properties in close interaction between experiment and theory. These include all device-relevant aspects, i.e. properties of bulk materials, alloys, and heterostructures with special regard to the different crystal structures, as well as doping, defects, etc.
- to assess the potential of these materials for novel devices and to make them available for new applications.
- to facilitate close interaction between growth, physical investigations and theory.
- to train young scientists in the vivid field of oxide materials.

Long-term vision: Materials by Design

Our long-term vision is to fuse GraFOx research in the fields of materials synthesis, experimental characterization and ab-initio theory into a modern platform that can predictively provide “Materials by Design”. This will enable a fundamentally new approach in the quest for new materials and new applications, away from intuition- and curiosity-driven research towards a directed search in close symbiosis between theoretical prediction and experimental verification.

GraFOx dynamics: extending basic research to device applications

GraFOx has the goal to form a comprehensive topical network with a strong international standing. It is a nucleus for the inclusion of further activities and partners and for winning further joint funding. This holds in particular for applications and device work which in the first phase received little funding.

Our strategy is to do solid materials science and fundamental research at first, but to extend our work to devices and applications whenever and wherever possible. Consequently, in the second funding phase started in 2020, we have taken up a new project cluster on device applications such as power electronics, UV detectors and conductometric gas sensors.

Some GraFOx achievements in numbers

Researchers from GraFOx have so far presented more than 50 invited talks at conferences and published more than 105 publications, of which 30% are joint publications from at least two partner institutions. Senior GraFOx researchers have (co)organized more than 12 international meetings or dedicated conference sessions. GraFOx groups have brought in more than 10 Mio. € of new project funding on top of the initial startup-funding of 1.2 + 0.9 Mio. € from the Leibniz Association for the first and second funding phase. GraFOx partner institutions provide about 2.1 + 2.7 Mio. € of co-funding, respectively. Starting with 12 PhD students and projects in 2016, GraFOx now has more than 33 projects with 25 PhD students.