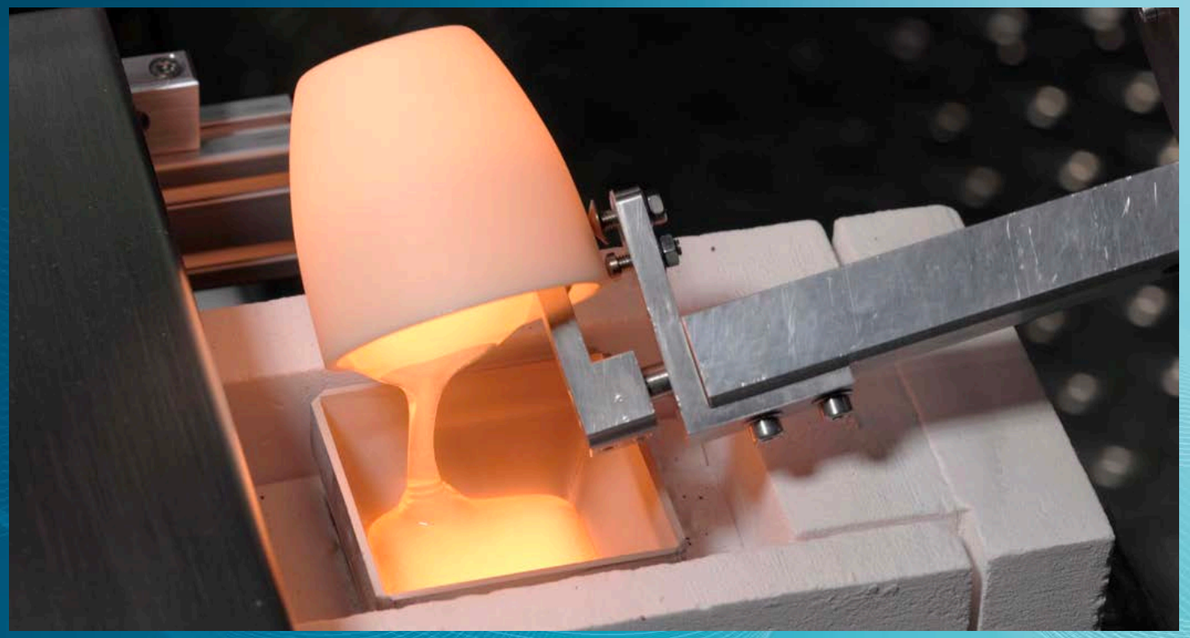

Fraunhofer ISC

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Glass Screening Apparatus

Automation in Glass Development for Lab 4.0

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How to use digitalization in glass development?

Dosing with up to 14 different components

Lab 4.0

Automation in Glass Development

Repository for up to 20 crusibles

Development of new technical glasses

Glass has played a significant role in the lives of humans for over three millennia: from jewelery and ritual objects, kitchen or table ware and windows to emerging applications such as bioactive implants and energy materials. However, despite the well-established history of this material, very few of conceivable glass compositions have been discovered and explored to date. The production or introduction of new multi-functional glasses requires a long and expensive period of development.

To overcome this time-consuming process, Fraunhofer ISC has developed a new generation of automated glass screening, a robot-controlled process line called »Glass Screening Apparatus«. It automatically handles all the necessary process steps automatically to develop new glass compositions using digital interfaces to transfer all data to a digital workflow.

The automation approach

This process automation enables a methodical development of glass systems through high reproducibility and digital process control. It generates all necessary data and leads to process optimization. Automatically produced glass samples deliver large quantities of data relating, for example, to Young's modulus, solubility and glass-transition temperature, which is a fundamental requirement to enhance and collect the data based knowledge of glass.

The robot-controlled process line is worldwide unique and covers four main process steps, which are handled by a robot and controlled by a main control station.

These four steps are:

- Mixing and weighing of up to 14 glass components
- Powder homogenization via robot mixing procedure
- Heating and melting with 3 inline furnaces up to 1700 °C
- Casting and controlled cooling with a special designed 3 zones cooling furnace

The robot autonomously performs these process steps using different types of gripping tools and several automated routines. All data (e.g. weighing results) are recorded digitally and reported during the entire process. The high level of automation facilitates up to 20 glass samples per day (depending on complexity of the glass composition) to be produced. Based on all data, the process line will be optimized through a feedback loop, generated by a digital twin, which is connected to the digital workflow and localized on a central material data server.

RANGE OF SERVICES

- Design approach of new types of glass according to costumized specifications
- Development of process parameters for glass production
- Characterization and interpretation of the properties of glass
- Customized device adaptations