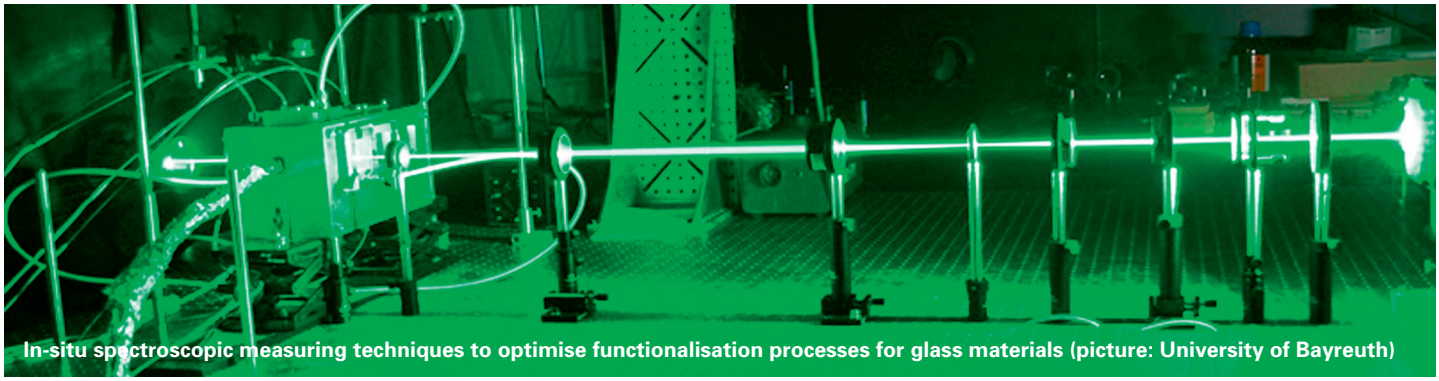
Bavarian research & innovation

FORGLAS

Bavarian Research Cooperation for Glass Materials for Energy-Efficient Construction

ENERGY FOR THE HOMES OF THE FUTURE



In-situ spectroscopic measuring techniques to optimise functionalisation processes for glass materials (picture: University of Bayreuth)

Imagine a future where buildings generate energy instead of merely consuming it. FORGLAS is dedicated to researching new glass-based multi-functional materials with this very vision in mind. The Research Cooperation seeks to create technologies not only for new builds, but also to convert existing buildings from energy consumers to energy savers. Its research work also provides the Bavarian glass industry with a much-needed perspective on the future.

As a material, glass has extraordinary potential for directly harnessing sunlight as a source of energy. One of the Research Cooperation's aims is to control properties such as reflection, transmission and wavelength conversion and combine them with other functions to create new materials that synergetically integrate the previously separate technologies of construction, glass and photovoltaics. The research partners – five scientific institutes and 13 companies representing the entire glass value-added chain – have set themselves the following goals:

- To develop new glass materials to sustainably improve the energy balance of buildings
- To develop new surface treatments which significantly improve existing glass materials and which are ecologically and economically feasible on a large scale
- To develop processes for turning new and established types of glass into semi-finished products and additives such as microspheres, flakes and fibres, to form the basis for new products and applications
- To design accelerated stress tests to simulate the behaviour of the new materials and products under realistic environmental conditions and obtain information about their long-term stability

FORGLAS is ideally equipped to achieve these objectives. It is the only institutional research body in Europe to have access to a melt screening system, a mini melter and the associated processing equipment. This glass manufacturing and processing equipment, very similar to real industrial production facilities, bridges the gap between fundamental research and actual product and process optimisation for the first time.

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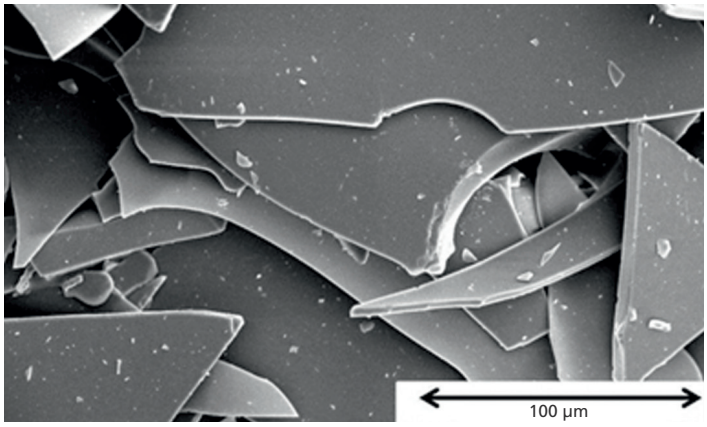
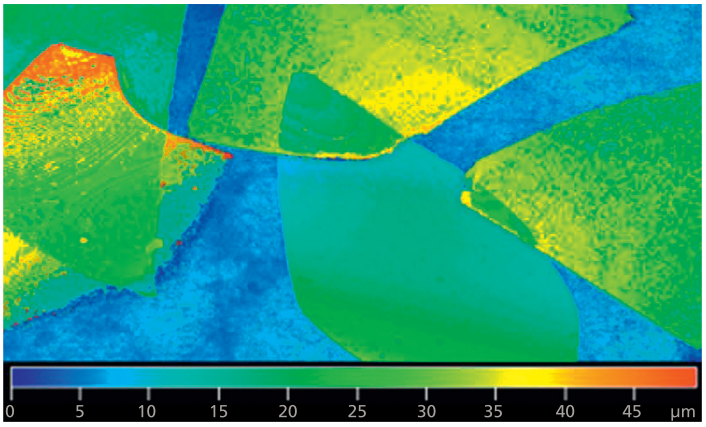
Funded by the Bavarian Research Foundation with € 2.2 million for 3 years.



Borosilicate glass flakes, around 1 µm thick, prior to coating (picture: University of Bayreuth)



False-colour image of glass flake as seen with a laser scanning microscope (picture: University of Bayreuth)

RESEARCH TOPICS

The research activities of FORGLAS cover three main areas, each subdivided into various individual projects:

Area I:
Special semi-finished products for light and heat management

The main concern of this research area is glass as a material and its various applications in building technology. One research team is working to create a type of architectural glass (the glass used in building construction) that allows the total energy transmittance (g value) to be controlled. In another project, researchers are developing glass-based additives for paints and plasters to achieve effective heat management on exterior and interior walls. These additives contain glass spheres or flakes which are functionalised by coating and thus optimised for the particular application. This will provide a simple and cost-effective way to make old buildings more energy-efficient. Other researchers are working on porous glass-based fillers for paints, plasters and putties to regulate the climate inside buildings. Manufacturing these microscopic flakes, less than 5 µm thick, represents an additional challenge.

Area II:
Glass development and processing technology

In order to manufacture glass and glass particles for both construction and photovoltaic applications, researchers have to turn to highly sophisticated technologies. Consequently, the second research area is concerned with the development of suitable machinery. In one project, researchers are seeking to build a fully automated glass screening system which, it is hoped, will significantly improve the development of new glass materials for solar, electronic and construction applications. Another project is focusing on the development and optimisation of mini melter technology so that it can handle high-melting and special glass materials, as well as the integration of other processing technologies. The third project team is using a laboratory glass kiln to study the corrosion behaviour of molybdenum and platinum alloys – materials used in glass melting.

Area III:
Interdisciplinary topics

The third area of research is concerned with topics that straddle the other areas. This includes, firstly, environmental behaviour and therefore the short-term and long-term stability of glass materials for integrated photovoltaic systems (solar cells). The aim is to develop optimised, more competitive solar modules that can be tested using comprehensive quality control methods. Secondly, the materials and wall constructions developed by the other groups are analysed and evaluated from an energy standpoint using model simulations. Researchers involved in the third project are developing spectroscopic methods for in-situ diagnostics and monitoring for glass functionalisation processes used by FORGLAS and making them available to the other projects.

Academic Partners:
- University of Bayreuth
  Chair of Metallic Materials
  Chair of Technical Thermodynamics and Transport Processes
  Chair of Materials Processing
- University of Erlangen
  Chair of Glass and Ceramics (WW3)
  Department of Material Sciences
- Fraunhofer Institute for Silicate Research

Industry Partners:
Centrosolar Glas GmbH & Co. KG
Eckart GmbH
Franken Maxit GmbH & Co.
Füller Glastechnologie Vertriebs GmbH
Gebrüder Dorfner GmbH & Co.
INTERPANE Glasgesellschaft mbH (IPP)
KEIMFARBEN GmbH & Co. KG
LIPEX Anlagentechnik und Handel GmbH
Nachtmann GmbH
Plansee Metall GmbH – Metallwerk
Schott AG
Sigmund Lindner GmbH
W.C. Heraeus GmbH