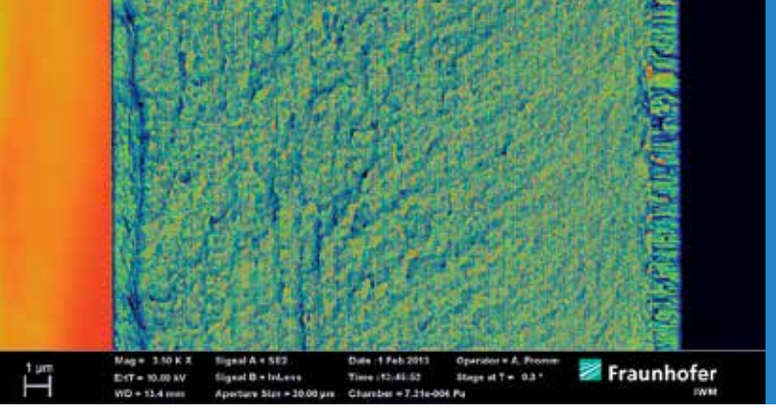


Multilayer Ni-Al coating on silicon for reactive joint processes.

FRAUNHOFER INSTITUTE FOR
MECHANICS OF MATERIALS IWM

Fraunhofer
IWM

FRAUNHOFER INSTITUTE FOR MECHANICS OF MATERIALS IWM

GLASS-METAL SOLDERED JOINTS

Joints in glass

We develop joint techniques that take into account the chemical, thermal and mechanical properties of glass as material. We functionalize glass surfaces by means of specially developed multi-layer coatings, evaluate soldering materials and adjust the process parameters as required. It is our aim to match the base material, solder material and process sufficiently closely that dimensionally stable and vacuum-tight joints are obtained.

- Development of coatings for the metalization and soldering of glass
- Development of low-stress bonds for large joint dimensions
- Mechanical characterization and qualification of joints
- Process simulation for joint technologies

Fraunhofer Institute for Mechanics of Materials IWM
Wöhlerstrasse 11
79108 Freiburg, Germany
Phone +49 761 5142-0

The Fraunhofer IWM is the point of contact for industry and public contracting bodies concerning component and systems reliability, safety, durability and functionality. The Fraunhofer IWM's "mechanics of materials" services focus on identifying weaknesses and defects in materials and components, determining their causes and building upon this to realize solutions – including material development, manufacturing processes and testing procedures – that lead to the efficient and reliable use of components.

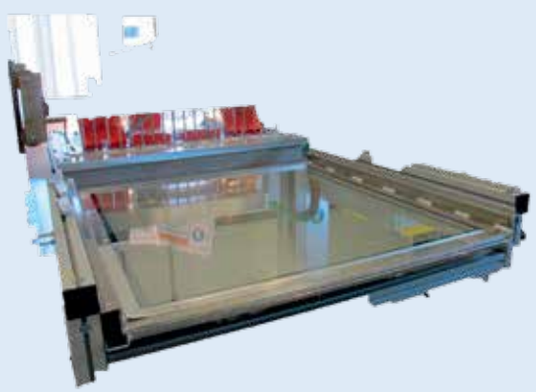
Contact
Matthias Gremmelspacher
Phone +49 761 5142-225
matthias.gremmelspacher@iwm.fraunhofer.de

Tobias Rist
Phone +49 761 5142-430
tobias.rist@iwm.fraunhofer.de

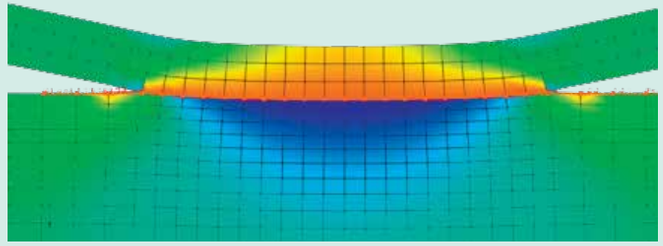
WWW.IWM.FRAUNHOFER.DE

f_1607_149e

View into a high-frequency magnetron system (coatings for glass soldering).



Seal testing for vacuum insulation glass (testing of a half-size VIG pane).



Stresses and deformation after joining of glass and metal.

Solder layer and application

To achieve a mechanically sound soldered joint, the glass must be coated all round with a layer of material capable of being soldered. This material must withstand high thermo-mechanical loading and must be well wetted on the surface by the liquid metal solder. At the same time, however, no diffusion of the metal solder must be allowed to occur through the coating to the glass surface in order not to have the adhesive strength of the joint compromised.

Coatings for the metalization and soldering of glass have been developed at the Fraunhofer IWM. A system of multiple layers with a ceramic bonding agent and solderable intermediate and cover layers has proved itself particularly suitable. Thus the metal band can be joined to the glass by means of a metal coating of the glass and soft solder.

Application for vacuum insulation glass (VIG)

A promising approach to realizing high-performance, high-insulation window glazing is to create a long-lasting high vacuum between two sheets of glass. To enable this, the space for the vacuum between the flat glass panes must be sealed so as to be gas-tight and pressure-tight.

A direct, rigid soldered join between the edges of the panes is only stable in the long term for small window dimensions. As the pane dimensions increase, the mechanical tensions acting at the rigid edge joint during use also increase.

An edge joint concept has been devised at the Fraunhofer IWM based on a soldering process that, featuring a flexible metal band between the panes, is also suitable for large glazing formats. The metal film used, is specially adapted to the thermal expansion of the glass and can be soldered to glass using a metal solder.

Soldered joint evaluation

To evaluate the mechanical strength of soldered glass-to-metal joints, a removal device is used to pull the metal film from the glass and thereby measure the adhesion strength.