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PRESS RELEASE

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Anodic bonding of space mirrors

Berliner Glas joins glass and ceramics such as SiSiC permanently and in an extremely stable manner by using anodic bonding. Berliner Glas has the competence to anodically bond not just circular surfaces, but also elliptic or angular components. As opposed to thermal bonding, the long-term adhesion is based on the exchange of charge carriers between both materials. This technology is increasingly used for space products which have to cope with strong cosmic radiation, shock and vibration stresses and severe temperature fluctuations. Here conventional joining processes often fail: gluing has the disadvantage of gas emissions, radiation sensitivity or a low temperature application range. Screwed connections could loosen under mechanical stress, so have to be additionally secured by an adhesive for space applications.

Using the example of a space mirror, developed and produced by Berliner Glas, the advantages are clear. A glass substrate, equipped with a mirror layer and thinned to approx. 100µm, is anodically bonded to supporting material with high thermal conductivity and rigidity. As a result the advantages of a highly-stable support can be ideally combined with the benefits of the glass as a coating substrate. The result is a product which is stable over a wide temperature range. Here the support material can additionally be equipped with light-weight structures in order to achieve a mass reduction of up to 90%. Using conventional methods a mirror with an extremely level surface can be created on the glass substrate. In addition the use of an electrically-conductive support offers the advantage that the mirror itself can be equipped with ESD (electro-static discharge) protection. Berliner Glas has also optimized the symmetrical mirror construction technology so that even any thermal stresses which may occur do not cause any detectable deformations to the reflected wavefront. Extremely high optical quality is therefore ensured even under the most difficult conditions.

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The anodic bonding for the space applications of Berliner Glas has been tested for durability ("space heritage"). It has also been exposed to high-energy radiation (Co-60) and an extensive life-span test. Due to the design between two solid bodies the join is also impervious to atomic oxygen and UV radiation. This means that a life-span of at least 15 years is possible even for geostationary operation. In addition this technology can of course also be used for LEO (low earth orbit) applications.

Anodic space bonding – an overview:

- Anodically bonded
- Adhesive-free
- At least 15 year life-span
- High rigidity
- Extremely stable
- Flatness: 15 nm rms
- Wavelength stability within 50° (layer design dependent on the desired temperature range)
- UV stable
- ESD protection
- ATOX-resistant
- High imaging quality
- Geo and LEO compatible

About Berliner Glas:
The Berliner Glas Group, with around 1000 employees, is one of the leading European providers of optical key components, assemblies and systems as well as high-quality refined technical glass. With an understanding of optical systems and optical production technology, Berliner Glas develops, produces and integrates optics, mechanics and electronics into innovative system solutions for its customers. These solutions are used worldwide in the semiconductor industry, medical technology, metrology, laser and space technology, analytics, defense and the display industry.

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