Biomed Tech 2012; 57 (Suppl. 1) © 2012 by Walter de Gruyter · Berlin · Boston. DOI 10.1515/bmt-2012-4268

Low temperature production process for hermetic transparent implant packages

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Introduction

The Artificial Accommodation System is a complex mechatronic micro system aiming to restore the accommodation ability of the human eye. The package of this lens implant has to be hermetic and must allow the transfer of visual light as well as electro-magnetic energy and signals. During the production process no thermal stress must be applied to the internal components.

Methods

In order to produce a hermetic transparent package, two glass parts are manufactured using ultrasonic grinding. These parts are joined adhesively. Since polymers are not hermetic, water can diffuse through the adhesive and harm the internal components. Therefore, the bond seam is coated by sputtering a hermetic material onto the surface of the adhesive and the neighbouring areas of the glass parts. Different samples are produced using titanium coating and SiO_2 coating. In order to determine the hermeticity of the produced packages, helium leak tests are used.

Results

Using the described process, cylindrical glass packages with a wall thickness of 300 µm to 350 µm can be manufactured. The adhesively joined packages withstand all forces applied during handling and even the exposure to vacuum during helium leak testing. Half of the samples coated with titanium are hermetic, according to the definition in MIL-STD-883 and therefore fulfil the current standardized requirements for implant packages.

Conclusion

Ultrasonic grinding of glass parts and subsequent coated adhesive joining is a very promising low temperature process to produce thin-walled transparent hermetic implant packages. For further reduction of the wall thickness and in order to increase hermeticity, both the manufacturing of the glass parts and the coating process shall further be optimised. In addition to the helium leak tests, accelerated aging will be performed.