Fast-tool-servo diamond turning of free-form intraocular lenses from hydrophobic acrylic polymer

W. Wang[1], O. Riemer[1], K. Rickens[1], T. Eppig[2,3]

[1]Leibniz Institute for Materials Engineering – IWT, Germany

[2]Advanced Medical Implant Consulting – AMIPLANT, Germany

[3]Institute of Experimental Ophthalmology – Saarland University, Germany

wang@iwt-bremen.de

Abstract

Intraocular lenses (IOLs) are diminutive plastic optical devices surgically implanted in the human eye to substitute the natural crystalline lens. The requirement for such cataract surgery arises when the natural lens becomes opacified by cataracts, significantly impeding vision or potentially resulting in blindness. In Germany, approximately 800,000 cataract surgeries are conducted annually.

To date, apart from moulding the prevailing method for manufacturing IOLs is single-piece on-axis diamond turning especially for small batch production and product variability as in toric lenses. In the scope of this project, an exploration of alternative techniques, i.e. off-axis diamond turning with fast-tool-servo, will be undertaken to increase the productivity and to manufacture highly customized lenses; a vacuum clamping system aiming to enable the simultaneous processing of multiple pieces will be developed. Specifically, hydrophobic acrylic polymer where deep cooling is required, rather than hydrophilic materials, will be used as raw materials, in order to meet the increasing market demand for hydrophobic IOLs.

The primary objective is to achieve enhanced production efficiency by realizing faster, more resource-efficient, and ultimately more cost-effective manufacturing processes. In this contribution, principle process designs for fast-tool-servo machining including vacuum clamping of hyhrophobic blanks are discussed and particular solutions are demonstrated.

Figure 1: Example of an intraocular lens with a 4-loop haptic, length approx. 11 mm