L A Hof et al., J Appl Mech Eng 2016, 5:3(Suppl)
http://dx.doi.org/10.4172/2168-9873.C1.003

Tool-glass bonding phenomenon during glass micro-machining by Spark Assisted Chemical Engraving (SACE) - Issues and opportunities

L A Hof[1], **J D Abou Ziki**[2] and **R Wüthrich**[1,3]
[1]Concordia University, Canada
[2]Laurentian University, Canada
[3]Posalux S.A., Switzerland

Glass is used as material for MEMS in industry and academia. This is mainly because of its unique properties, like optical transparency and chemical inertness. However, the hardness and brittleness of glass complicates its micro-fabrication. In particular, smooth, high aspect-ratio microstructures are difficult to obtain. Among micromachining methods, Spark Assisted Chemical Engraving (SACE) has a strong potential to fulfill these requirements. Glass machining by SACE occurs due to thermally promoted etching. In this contribution, a recent finding in SACE will be explored. Preliminary experimental results show the unique feature that a chemical bond can be formed, similar to anodic bonding, between the tool-electrode and glass substrate when an appropriate force and temperature, typically around 300°C, is applied. This 'bonding temperature' can be controlled by the machining voltage and tool-sample pressing time onto the substrate. Currently, this bonding phenomenon is very sensitive to machining parameters and its fundamentals are not yet well understood. Research is needed to explore this phenomenom more deeply and to define a work space for machining parameter settings where the tool-glass bond can be achieved. This work aims to record clear measurable bonding forces by conducting experiments whereby the tool size and the machining prameters that affect the bonding force (including electrolyte type, machining voltage, machining force and duration of tool-glass contact) will be varied. A dimensionless correlation is established between the tool dimension and the mentioned machining variables towards getting a deeper insight about the nature of this phenomenon and its influence on the SACE machining process.

Biography

L A Hof is pursuing his Doctoral research in Mechanical Engineering at Concordia University, Canada, on nanoparticle imprinting on glass substrates by Spark Assisted Chemical Engraving. He obtained his Master (with Honours) and Bachelor degree in Mechanical Engineering, Advanced Mechatronics, in 2004 from Delft University of Technology, The Netherlands, and did his Master's research on 3D micro-structuring of glass at École Polytechnique Fédérale de Lausanne, Switzerland. He is winner of several awards including the prestigious doctoral Quebec Merit FQRNT award, was nominated for the Vanier CGS and wrote more than 15 journal and conference papers. His research interests include: Micro-/nano systems and advanced manufacturing processes.

lucas.hof@gmail.com

Notes: