3D printing Bullseye glass preform for fibre drawing

X. Pan[a,b], M. Denker[c], A. Radionova[a,b], Y. Wei[a,b], E.P. Schartner[a,b], T. Koutsonikolas[d], and H. Ebendorff-Heidepriem[a,b]

[a] *School of Physical Sciences, The University of Adelaide, Adelaide, SA, 5005, Australia.*

[b] *Institute for Photonics & Advanced Sensing, The University of Adelaide, Adelaide, SA, 5005, Australia.*

[c] *Institute for Machine Elements, Design and Manufacturing, Freiberg, Germany*

[d] *Maple Glass Printing Pty Ltd, Melbourne, VIC, 3070, Australia.*

3D printing of materials has been an ever expanding field in recent years, and significant progress has been made on manufacturing complex and unique three-dimensional objects in materials such as polymer,metal and ceramic [1]. There has also been some recent research on the use of this technology for glass fabrication, covering both indirect methods involving nanoparticles [2], as well as direct methods such as filament extrusion [3]. In this research, we focused a filament extrusion method, using a new commercial glass printer (Maple 2^{TM}), where the objects are directly printed from a soda-lime glass filament. The filaments were heated and extruded through a 1.5 mm nozzle to print the designed objects, with the goal of producing glass preforms which could be drawn to fibre and characterised for their physical and optical properties. Using a layer thickness of 0.5 mm we demonstrated complex delicate art pieces with overhanging features and reduced infill to save weight (Figure 1A, a Koala), and tubes which were subsequently drawn to fibre (Figure 1 B). This method shows good promise for future fabrication of complex structures for microstructured fibre fabrication.

We acknowledge the financial support of DAAD funding, technical supports of ANFF Optofab and Maple Glass Printing.

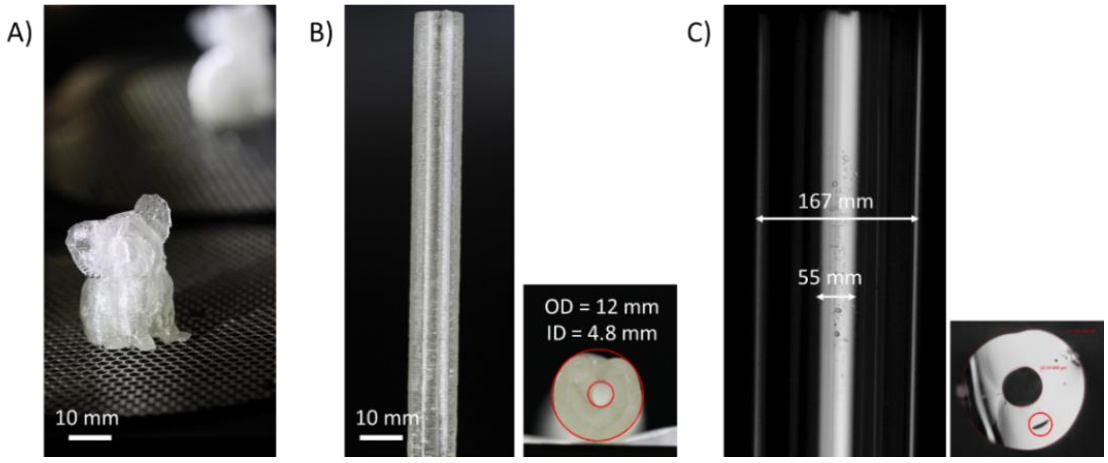

Figure 1. A) 3D printed glass Koala, B) 3D printed tube preform, length ~100 mm. C) A capillary fibre drawn from (B), with outer diameter of 167 µm.

[1] Y. Luo, et al., *Optical Fiber Technology* **2020**, *58*, 102299.

[2] Y. Chu, et al., *Optics letters* **2019**, *44*, 5358-5361.

[3] J. Luo, et al., *Journal of Manufacturing Science and Engineering* **2017**, *139*.