

# Designer glasses for ultra-low loss optical waveguides for lightwave circuits

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Integral to our modern optical communication networks are integrated photonics circuits that require low loss components. Ultrafast laser inscription being an attractive technique for waveguide fabrication utilizes commercial glasses which are either lossy due to transition metal inclusions, features low index change and uncontrollable morphology. Investigating a wide range of commercial glasses has shown that modifying the glass composition can be a way to remove the bottle necking of index change and asymmetrical morphology of laser-inscribed waveguides[1, 2]. A novel glass has been designed whose composition is carefully adjusted to achieve low loss, high index change laser written waveguides. We demonstrate that the performance of such a glass is superior in terms of index change achieved and in controlling the waveguide morphology. The waveguide propagation losses at 1310 and 1550 nm were as low as 0.05 dB/cm, which is much lower than any prior reports in other commercial glasses. The circular waveguide morphology across a broad laser inscription window ensures low loss coupling to optical fiber cross section reducing coupling losses.

[1] T T Fernandez, S Gross, A Arriola, K Privat and M Withford, *APL Materials* **9**, 121109 (2021).

[2] T T Fernandez, S Gross, K Privat, B Johnston and M Withford, *Advanced Functional Materials* **32**, 2103103 (2022).