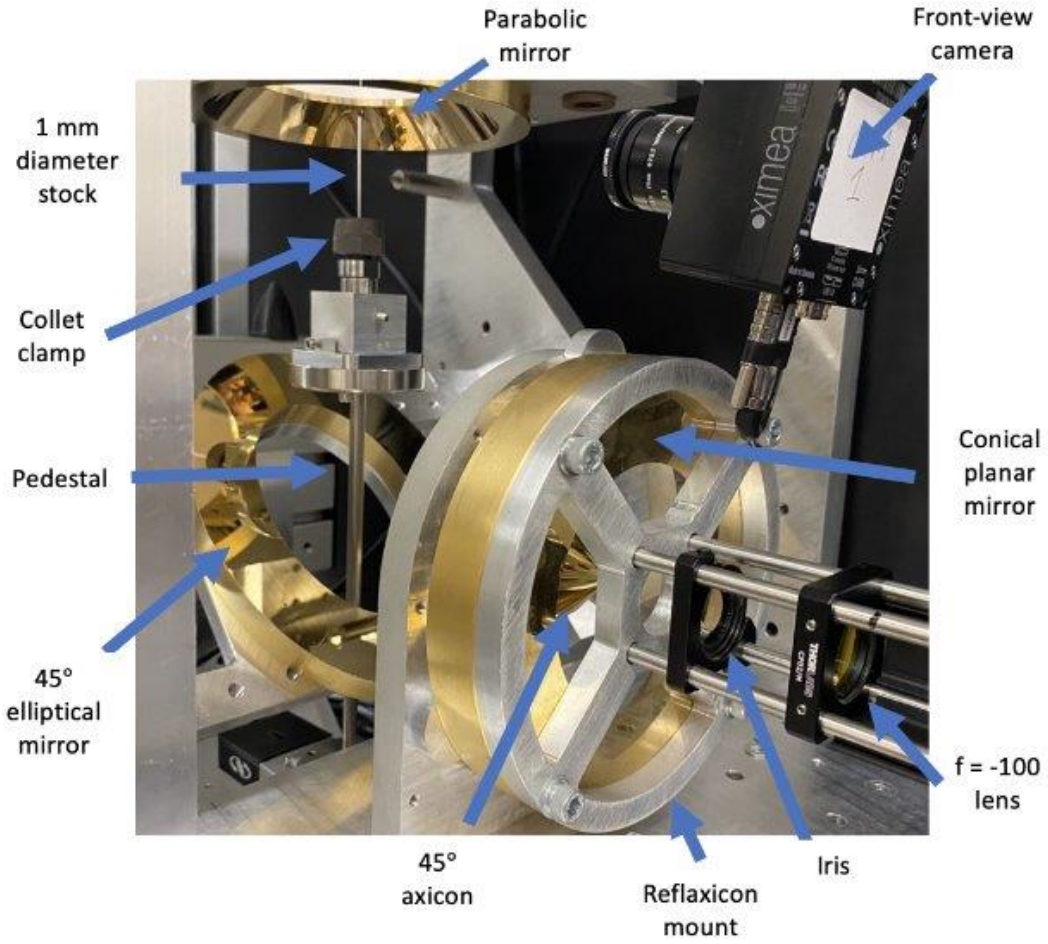
# Sapphire fibre growth




| Peak stress (MPa) | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| Stock | 366 | - | - |
| Fibre 1 | > 460 | > 710 | > 634 |
| Fibre 2 | > 543 | > 625 | > 792 |
| Fibre 3 | > 109 | - | - |

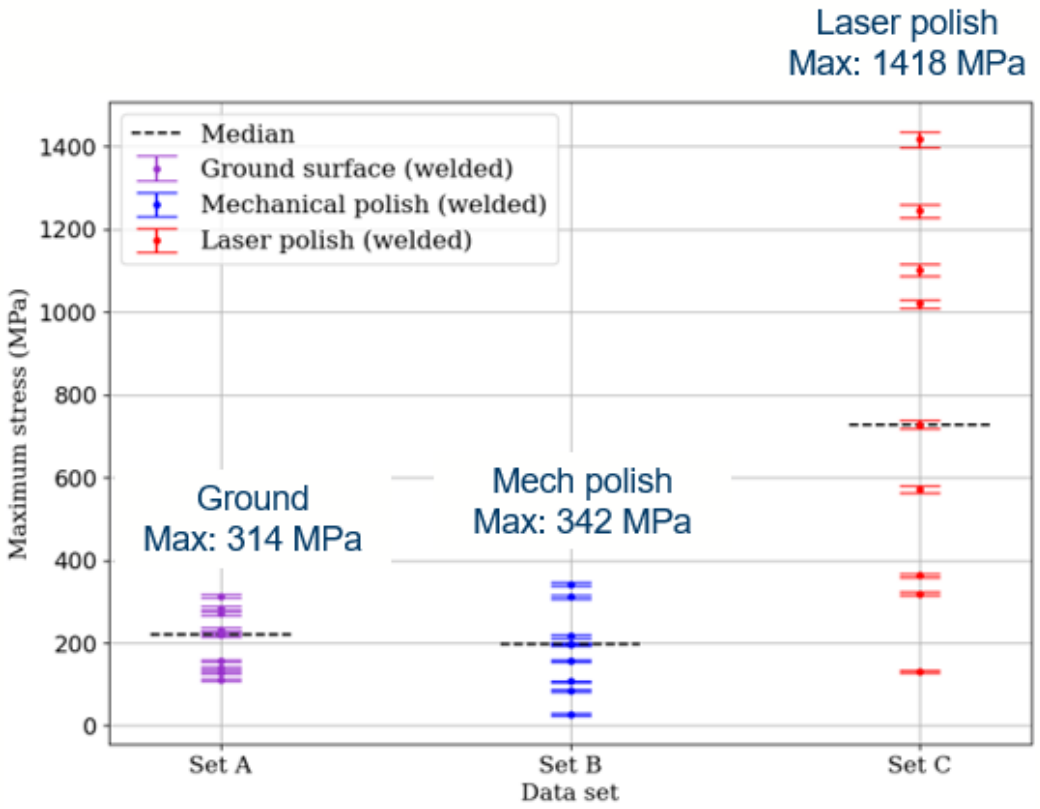
Table 5.1: The results of the strength testing

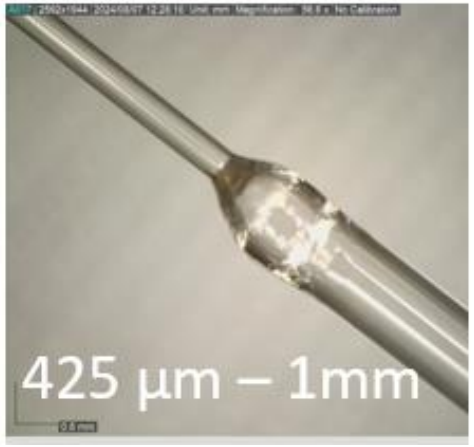
- Laser heated pedestal growth method used to produce sapphire fibres
- 1 mm in diameter, 350 mm long
- Peak strength of 792 MPa (unbroken)
- Good surface quality and diameter tolerance (±5% fibre diameter)

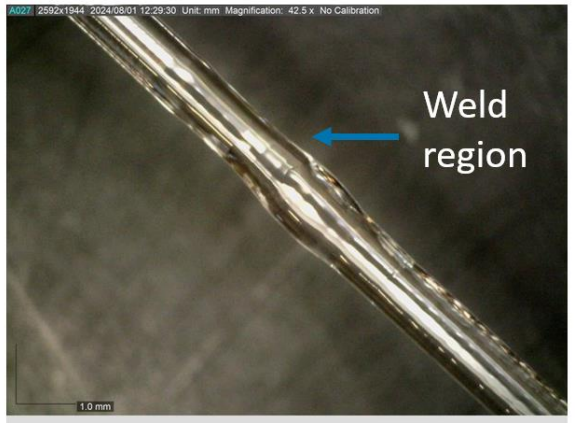
J. Callaghan. “Development of crystalline suspension fibres for next generation gravitational wave detectors.” PhD thesis. University of Glasgow. Aug 2024

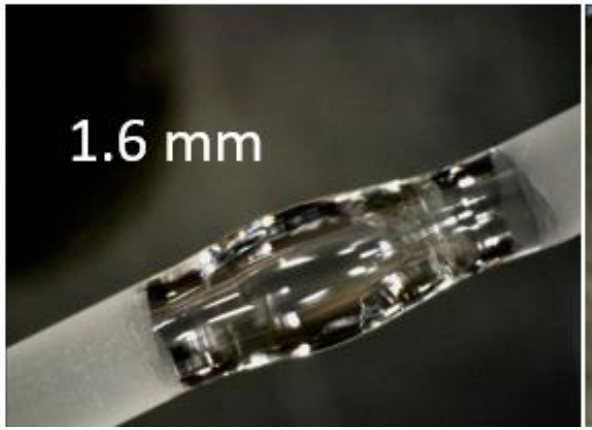
# Sapphire welding

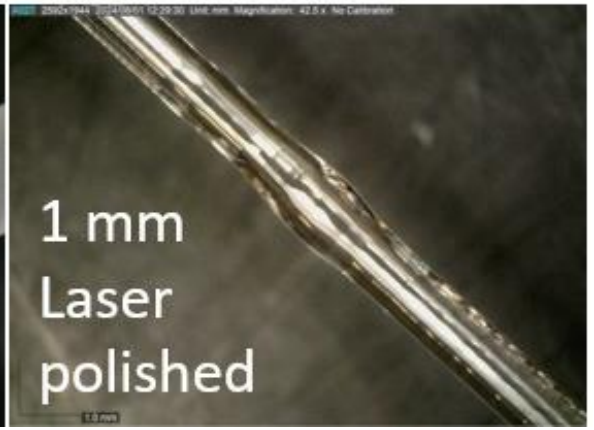
- 425 µm - 1.6 mm diameter samples welded
- Ability to repair/reweld repeatedly
- Highest maximum stress observed: **1.4 GPa (unbroken)**
- Laser polished samples significantly stronger than ground and mechanically polished samples
- No welds were broken



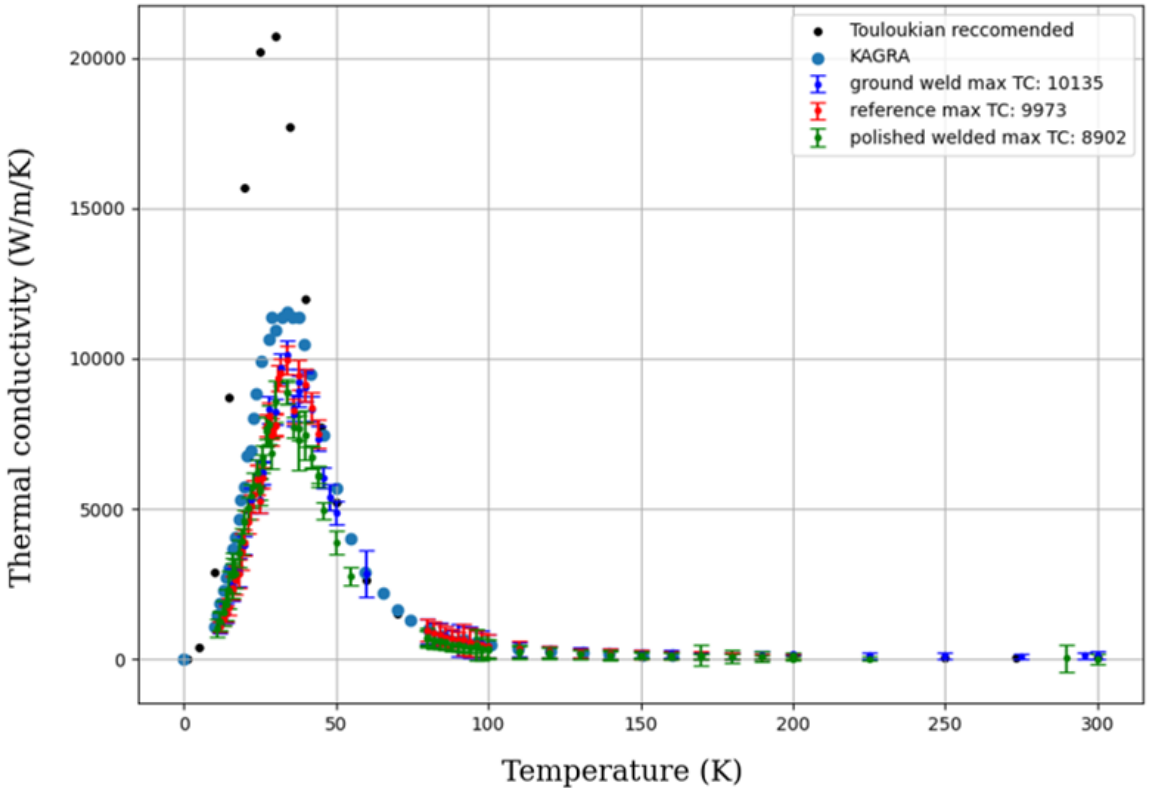



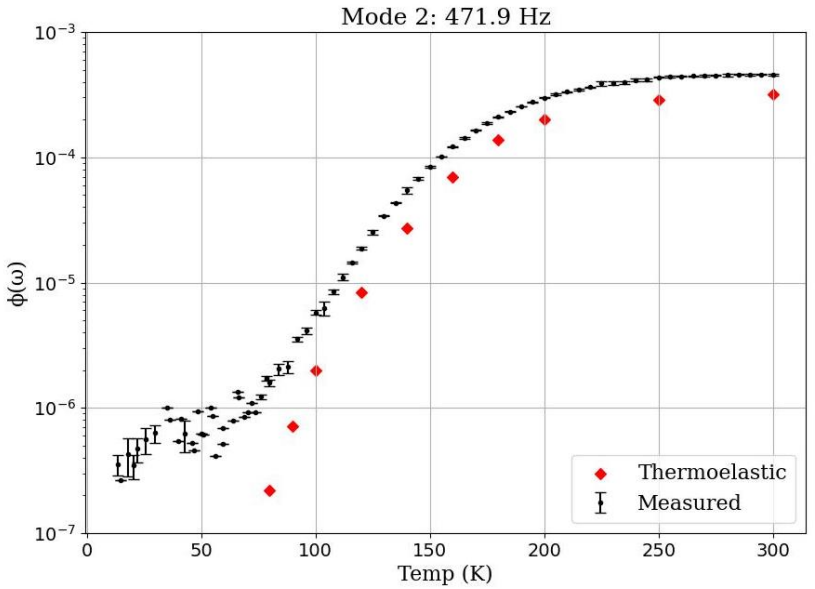



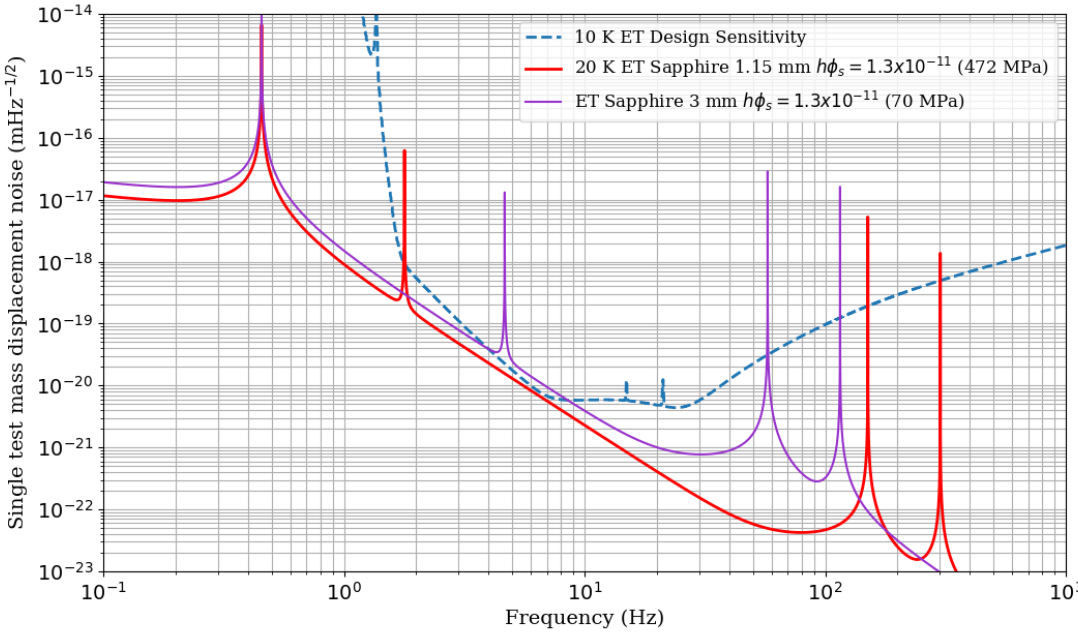



# Sapphire Thermal Conductivity & Mechanical Loss

- Measured down to 13 K for six resonant modes
- Ringdowns measured at ~5 K intervals
- Using welded 425 µm fibre to  1 mm rod
- Infer $h\emptyset_s$ of $1.3 \times 10^{-11}$ (cannot decouple surface and weld)




M.M Reid, PhD thesis, University of Glasgow. Aug 2024, https://theses.gla.ac.uk/41177/
Mariela Masso Reid et al 2023 Class. Quantum Grav. 40 245006