Can we produce high power visible light using doped silicate fibre?

Stuart D. Jackson

[a] *MQ Photonics, School of Engineering, Macquarie University, North Ryde, NSW 2109, Australia.*

Abstract: In this talk I will propose several ideas to create moderate-to-high power light using rare earth doped silicate fibre. The wide availability of high-power visible diode lasers that are affordable has created enormous opportunities – now is the time to exploit them for high power visible light systems. Fig. 1 displays the maximum output power from diode pumped fibre lasers as a function of emitted wavelength. Fibre lasers emitting in the infrared have been a game changer impacting all fields. Low loss silicate fibre has been the important enabling step allowing light to propagate in fibre at very low loss. Extension to the mid-infrared has been enabled by low loss fluoride fibre, and fluoride fibre is used for visible light generation. Fluoride fibre has its limitations; it cannot emit high power and it is expensive. Silicate fibre is transparent in the visible, so the obvious question is why we don't use doped silicate fibre to create high power visible light?

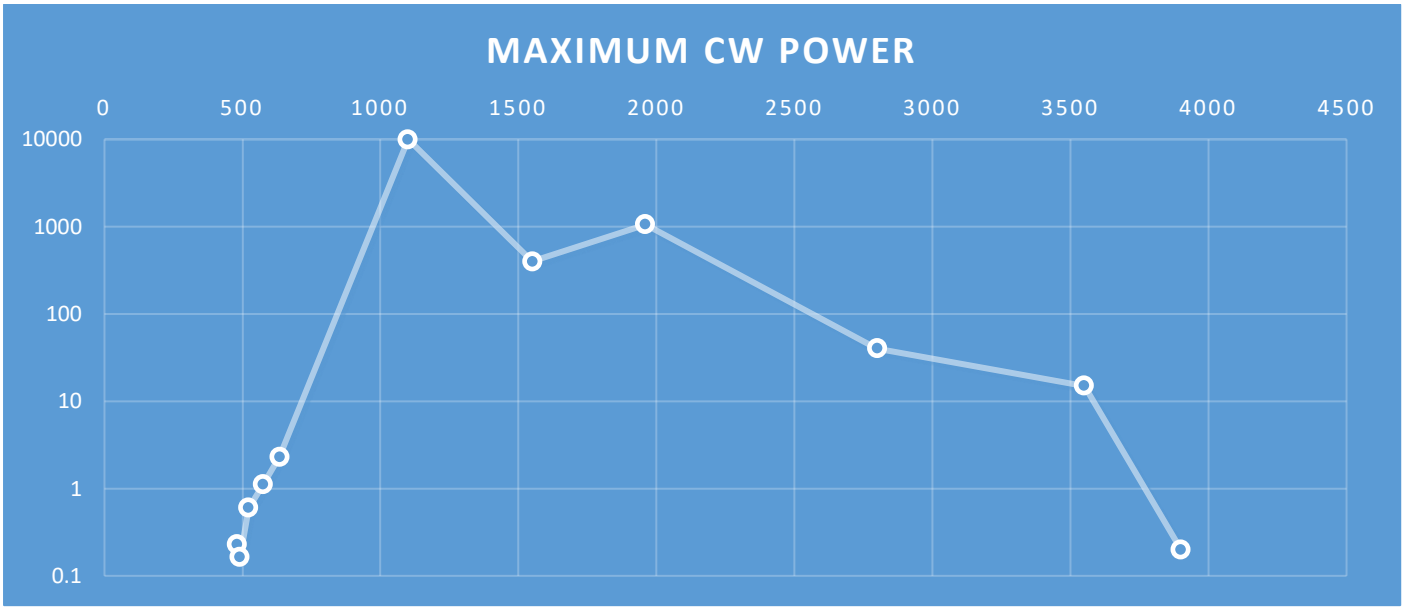

Fig.1: Maximum cw power emitted from rare earth doped silicate and fluoride glass optical fibre as a function of the emitted wavelength.

There are a small number of rare earth transitions that have been shown to emit laser radiation at visible wavelengths from a silicate fibre [1-3]. Photodegradation is the key problem that will most likely limit the visible power that could be generated. In this talk, I will discuss ways we could reduce photodegradation at visible wavelengths so that at least Watt-level output will be possible from an all-silicate fibre laser arrangement.

[1] Farries, *et al.*, Samarium^{3+}-doped glass laser operating at 651nm," *Electron. Lett.* **24** 709 (1988).
[2] Majewski, Jackson "Diode pumped silicate fiber for visible laser emission" *OSA Continuum* **4** 2845 (2021).
[3] Okazaki, *et al.*, "Diode pumped visible Dy^{3+}-doped silica fiber laser: Ge-co-doping effects on lasing...," *Appl. Phys. Express* **15** 012002 (2022)