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University of Southampton - ORC - Yun Wang - yw11e13@soton.ac.uk

The excel file contains experimental data for the paper. In particular:

**FIG. 1b** Energy-dispersive X-ray spectroscopy scan of the $Gd^{3+}$-doped phosphosilicate preform core area. The dip at the preform center is commonly observed in MCVD fiber preforms and is attributed to the evaporation of $P_2O_5$ during consolidation, which also removed $Gd^{3+}$.

**FIG. 2a** Phosphosilicate fiber transmission spectrum

**FIG. 2b** 2D PL/PLE spectral mapping of the phosphosilicate fiber sample. The excitation and emission mapping step were 0.5 nm and 1nm respectively.

**FIG. 4a** 2D PL/PLE spectral mapping of the phosphosilicate preform disk. Due to the weak excitation intensity at short wavelengths, mappings were taken on multiple sub-areas with scanning step ranging from 0.5 nm to 2 nm before combination.

**FIG. 4b** PL (excitation wavelength $\lambda_{ex}$=272.5 nm) and PLE (emission wavelength $\lambda_{em}$=312 nm) spectra. Slit widths as well as the peak values differ because of the increased excitation and emission slit widths used for PL and PLE signal optimizations respectively. The wavelength ranges are limited to the data available for correction, based on the wavelength dependent source power and detector sensitivity.

**FIG. 5** PLE spectra of ODCs at two emission wavelengths ($\lambda_{em}$) in the phosphosilicate preform sample.

**FIG. 6a** 2D PL/PLE spectral mapping,

**FIG. 6b** PL ($\lambda_{ex}$=274 nm) and PLE ($\lambda_{em}$=314 nm) spectra of the $Gd^{3+}$-doped silica fiber sample extracted from 2D mapping.

Abbreviations used:

**$\lambda_{em}$**: emission wavelength

**$\lambda_{ex}$**: excitation wavelength

**PL**: photoluminescence

**PLE**: photoluminescence excitation

Date of data collection: from Nov 2015 - 2016

Information about geographic location of data collection: University of Southampton, U.K.