

The Royal Academy  
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## Research Fellowship

### Erbium-Erbium interaction in long-lived perfluorinated organic waveguide materials.

Co-funded by EPSRC

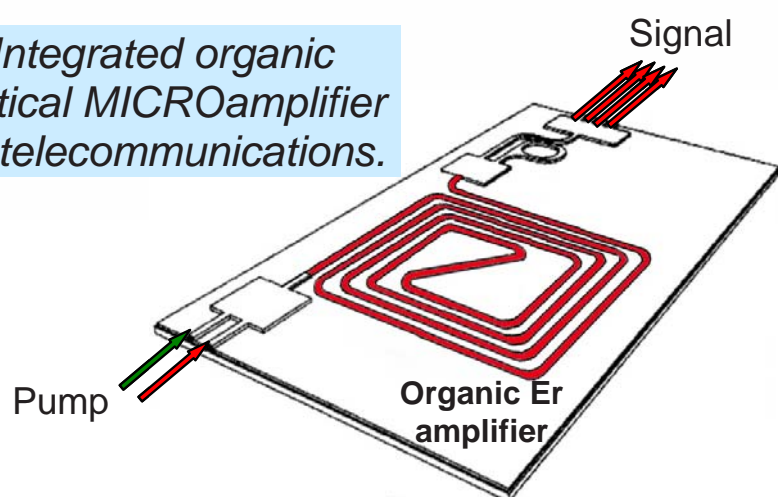
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#### Introduction. Aims.

*Integrated organic  
Optical MICROamplifier  
for telecommunications.*



#### ORGANIC:

- Integration
- Size
- Synthesis
- Number of emitters
- Sensitization

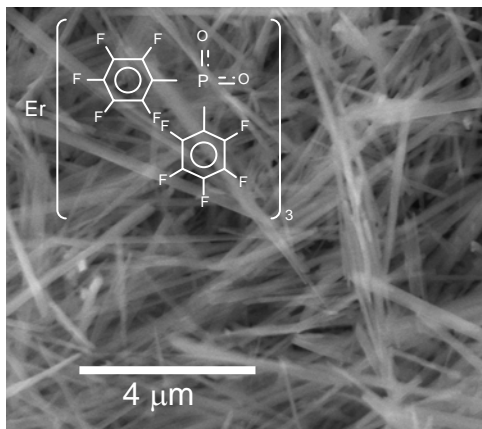
#### High gain:

- Lack of non-radiative processes
- High photoluminescence (PL) lifetime

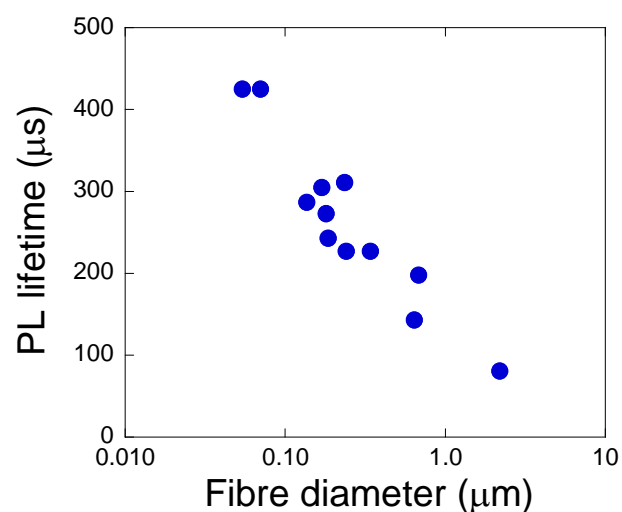
#### Precautions:

- No C-H, O-H, N-H bonds (**perfluorinated**)
- Aromatic rings / Blended with sensitizers
- Er-Er interactions

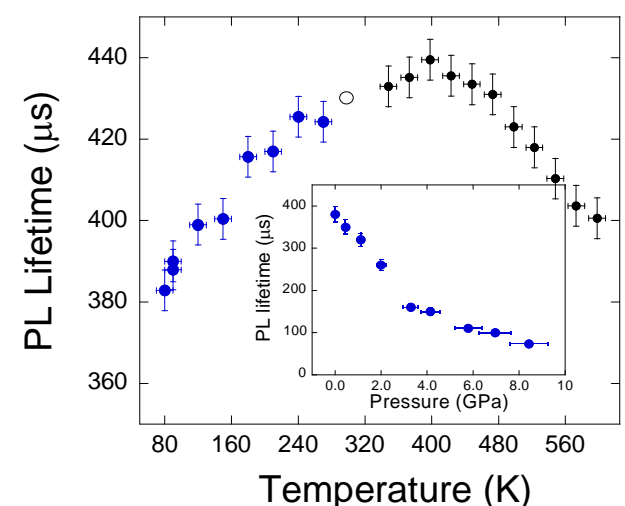
#### Materials. Results.



- Fibres
- Size, diameter, depend on synthesis



- PL lifetime increases when  $\varnothing$  decreases.



- Non-radiative processes are enhanced at low temperature and high pressure: contraction

#### Conclusions and further work.

- Erbium-erbium interactions are taking place in these systems.
- Photoluminescence lifetime (quantum yield) is limited due to non-radiative de-excitation processes.
- Erbium-erbium interaction increases with shorter inter-molecular distances.
- Cross-relaxation and energy migration are the main non-radiative mechanisms [1].

Two strategies to increase the efficiency:

**DILUTION** (lifetime ~ 717 μs)

**LARGER LIGANDS** for Erbium (lifetime ~ 2 ms)

[1] Ignacio Hernández, R. H. C. Tan, J. M. Pearson, P. B. Wyatt, W. P. Gillin J. Phys. Chem. B 2009 113, 7474-7481