

Corresponding author(s):

 Initial submission Revised version Final submission

Lasing Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form is intended for publication with all accepted papers reporting claims of lasing and provides structure for consistency and transparency in reporting. Some list items might not apply to an individual manuscript, but all fields must be completed for clarity.

For further information on Nature Research policies, including our [data availability policy](#), see [Authors & Referees](#).

► Experimental design

Please check: are the following details reported in the manuscript?

1. Threshold

Plots of device output power versus pump power over a wide range of values indicating a clear threshold

 Yes No

2. Linewidth narrowing

Plots of spectral power density for the emission at pump powers below, around, and above the lasing threshold, indicating a clear linewidth narrowing at threshold

 Yes No

Resolution of the spectrometer used to make spectral measurements

 Yes No

3. Coherent emission

Measurements of the coherence and/or polarization of the emission

 Yes No

4. Beam spatial profile

Image and/or measurement of the spatial shape and profile of the emission, showing a well-defined beam above threshold

 Yes No

5. Operating conditions

Description of the laser and pumping conditions
Continuous-wave, pulsed, temperature of operation

 Yes No

Threshold values provided as density values (e.g. W cm⁻² or J cm⁻²) taking into account the area of the device

 Yes No

6. Alternative explanations

Reasoning as to why alternative explanations have been ruled out as responsible for the emission characteristics
e.g. amplified spontaneous, directional scattering; modification of fluorescence spectrum by the cavity

 Yes No

7. Theoretical analysis

Theoretical analysis that ensures that the experimental values measured are realistic and reasonable
e.g. laser threshold, linewidth, cavity gain-loss, efficiency

 Yes No

8. Statistics

Number of devices fabricated and tested

 Yes No

Statistical analysis of the device performance and lifetime (time to failure)

 Yes No

► Further reading

We also suggest that authors read the following literature, which describes the important principles and signatures of laser emission and discusses some of the common mistakes that can occur during laser characterization.

1. Samuel I.D.W., Namdas, E.B. & Turnbull, G.A. [How to recognize lasing](#). *Nat. Photon.* **3**, 546-549 (2009).
2. Siegmann, A.E. *Lasers*. (University Science Books, 1990)
3. Svelto, O. *Principles of Lasers*. 5th edn. (Springer 2010)
4. Blood, P. *Quantum Confined Laser Devices: Optical Gain and Recombination in Semiconductors*. (Oxford Univ. Press, 2015)
5. Koxlov, V.G. *et al.* [Laser action in organic semiconductor waveguide and double-heterostructure devices](#). *Nature* **389**, 362-364 (1997).

FOR REFERENCE ONLY