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# Electroplated Cu-substrate: an efficient solution for heat dissipation in 1500-nm VECSELs

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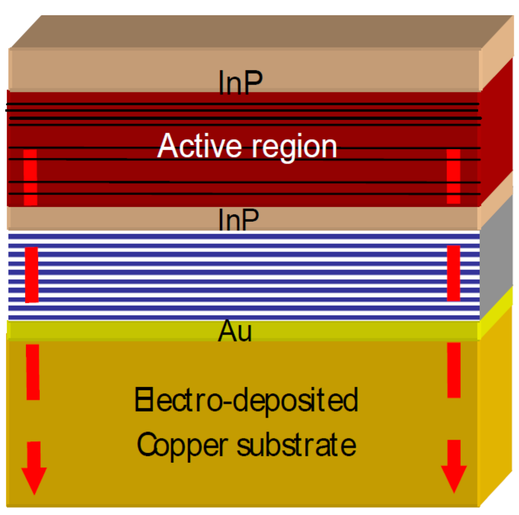
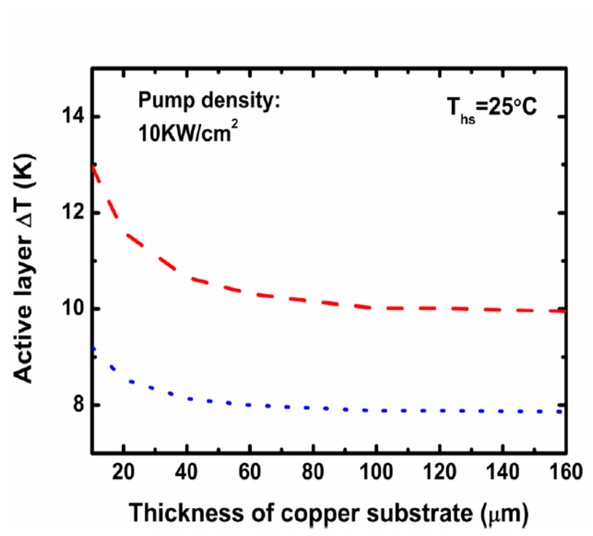
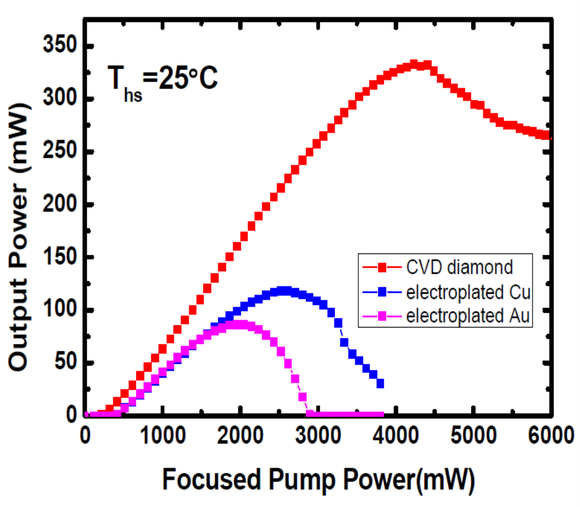
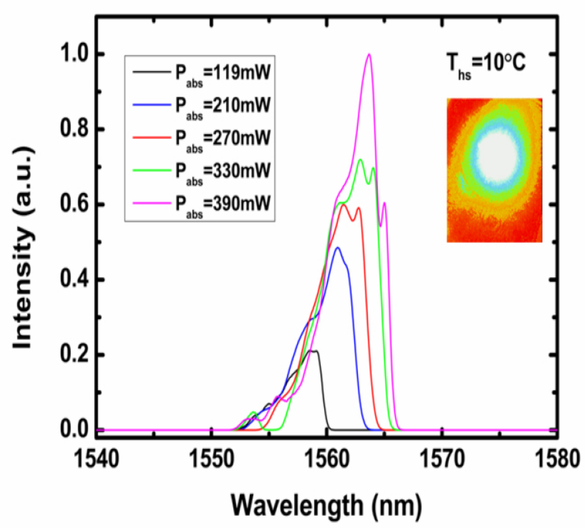
## Optically-pumped (OP) VECSELs




Schematic of the VECSEL and simulation results for 30 $\mu$m (blue) and 50 $\mu$m (red) radius of pump spots.

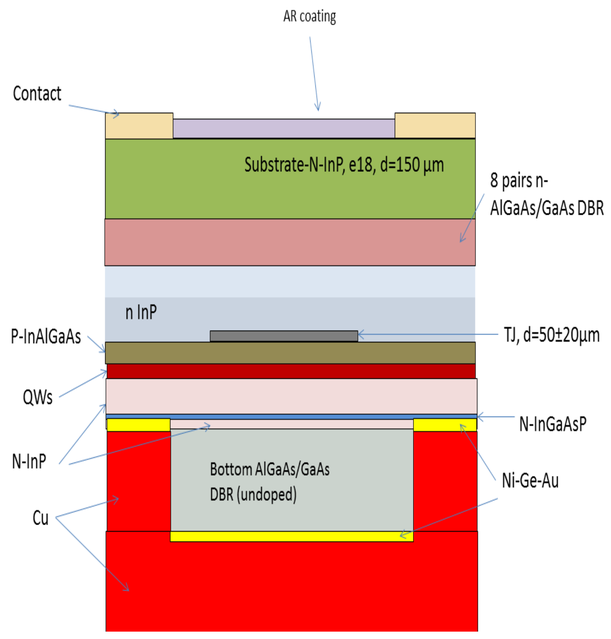


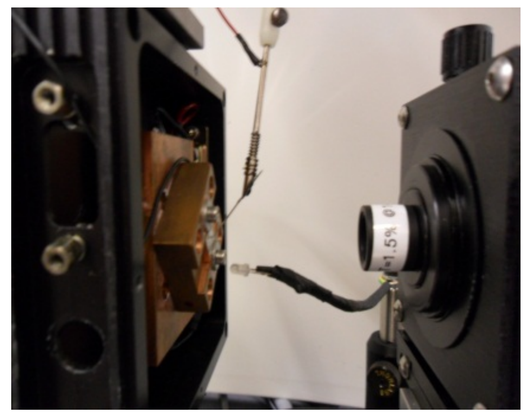




Light-light characteristics and spectra of VECSELs on electroplated Cu substrate. Thermal impedance is 40 K/W for 100 $\mu$m pump spot.

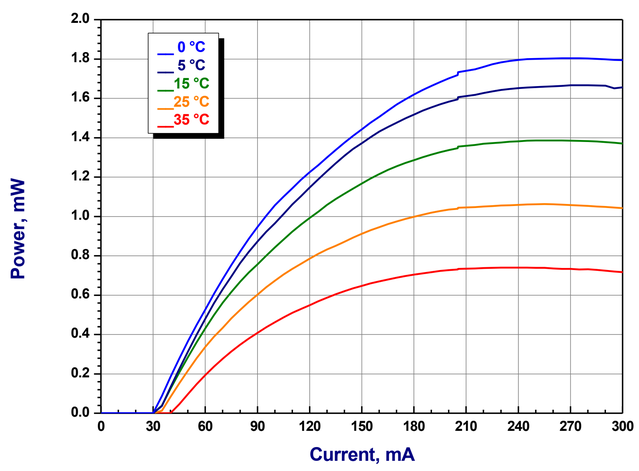
Z. Zhao, S. Bouchoule, L. Ferlazzo, A. Sirbu, A. Mereuta, E. Kapon, E. Galopin, J.-C. Harmand, J. Décobert, and J.-L. Oudar, *IEEE JQE* **48**, 643 (2012).

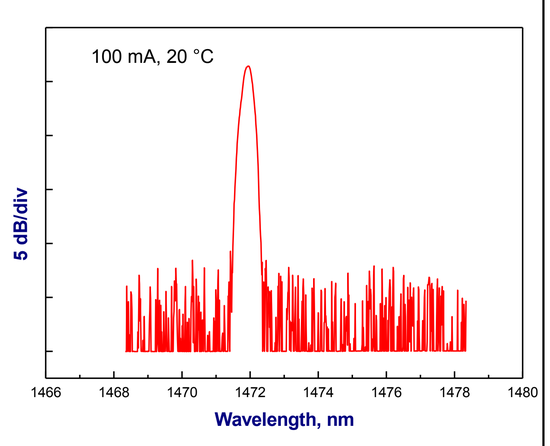
## Electrically-pumped (E) VECSELs



E-VECSEL on electro-plated Cu: schematic and test set-up with 1.5 % output coupler.




Light-current characteristics and spectrum of a device with 50 $\mu$m aperture.

A. Sirbu, A. Mereuta, A. Caliman, V. Iakovlev, G. Suruceanu, N. Volet, J. Rautiainen , J. Lyytikäinen, O. Okhotnikov and E. Kapon, *Proc. SPIE* **8432** (2012).

**Conclusions:** Electroplated copper substrate is an efficient solution for heat dissipation in VECSELs. Its application results in low thermal impedance in OP-VECSEL and first demonstration of E-VECSELs at 1500 nm. E-VECSEL performance will be further improved by using low doped intra-cavity InP substrate and optimized output coupling.