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# QC laser sets new wall-plug-efficiency record

Researchers at Northwestern University (Evanston, IL), who previously developed mid-IR quantum-cascade semiconductor lasers (see www.laserfocusworld.com/articles/233997), are reporting another milestone in power output and wall-plug efficiency for their devices. Despite optimization of strain-balanced heterostructures based on indium phosphide/gallium indium arsenide/aluminum indium arsenide that led to high-power, continuous-wave, room-temperature-operating lasers, wall-plug efficiency was still poor. But by optimizing efficiency parameters such as the temperature difference between the heat sink and the active region of the laser, the structure design, and material quality, the Northwestern team has demonstrated power levels of 675 mW at room temperature with a 9.3% wall-plug efficiency and power levels of more than 1 W at 150 K with a wall-plug efficiency greater than 18% at a wavelength of approximately 4.7 µm.

Wall-plug-efficiency parameters were optimized by incorporating high-quality strain-balanced interfaces within the core of the quantum-cascade laser, creating a low-loss indium phosphide waveguide above the core region with high thermal conductance, and by bonding the devices to a diamond submount using indium solder. These structurally and thermally advantageous design modifications more than doubled the wall-plug efficiency of previous designs. Contact Manijeh Razeghi at razeghi@eecs.northwestern.edu.