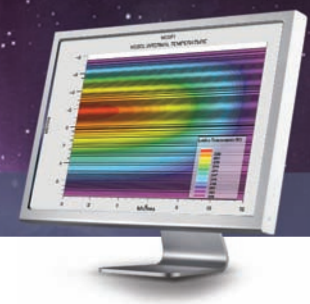
VCSEL

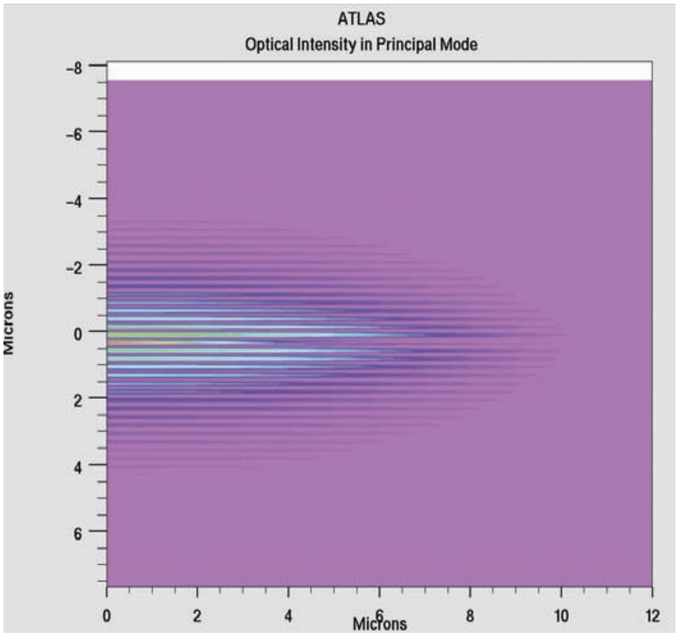
Vertical Cavity Surface Emitting Laser Simulations



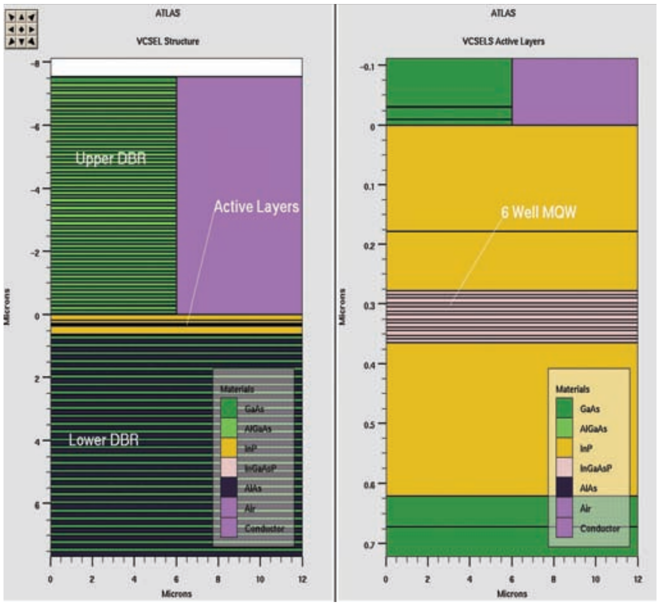
VCSEL is used in conjunction with the Atlas framework to produce physically based simulations of vertical cavity surface emitting lasers (VCSELs). VCSEL joins sophisticated device simulation to obtain electrical and thermal behavior with state of the art models for optical behavior.

Features

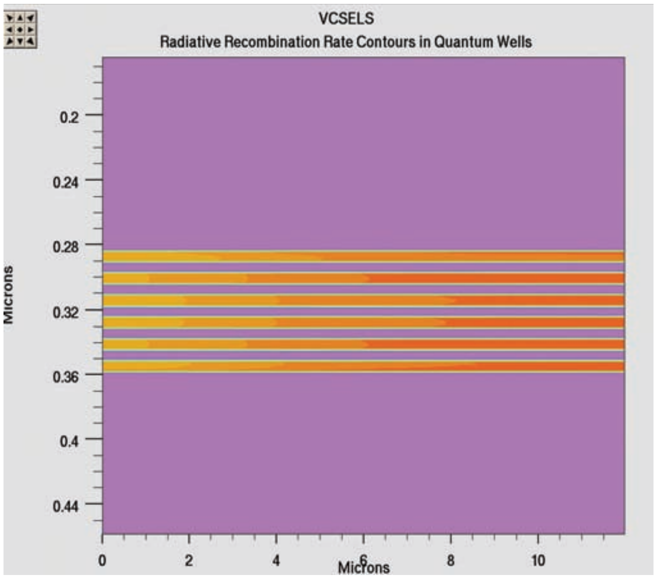
- Self-consistent solution of the equations describing device electrical, thermal and optical behavior
- Self-consistent solution of the Helmholtz equation in cylindrical coordinates to accurately predict optical intensity distribution for complex structures with multi-layer distributed Bragg reflector mirrors as well as strained multiple quantum well active regions
- Models for gain and spontaneous recombination that include the effects of quantum confinement and of lattice mismatch induced strain



Optical intensity of the principal longitudinal and transverse mode. This mode is lasing at the designed wavelength.

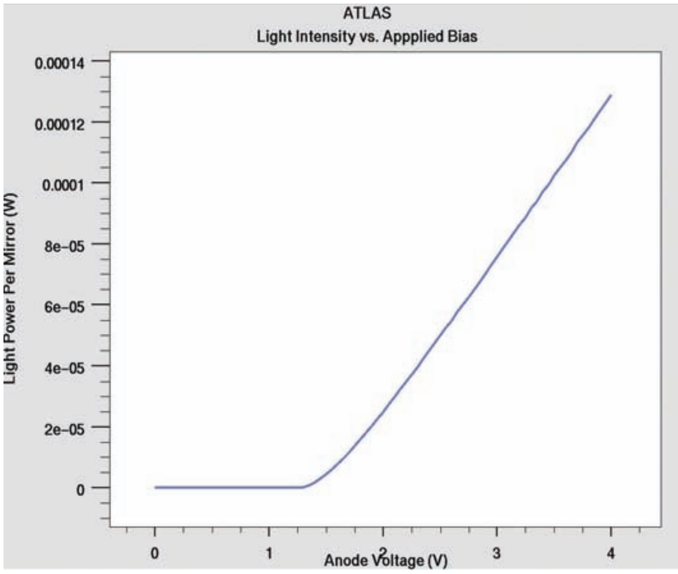


Cross-section of a typical VCSEL device. On the left the we see the entire cross-section which shows both the upper and lower DBRs and the active layers. The right panel shows the enlarged cross-section around the active layers where we can see that this device contains a six layer multiple quantum well.

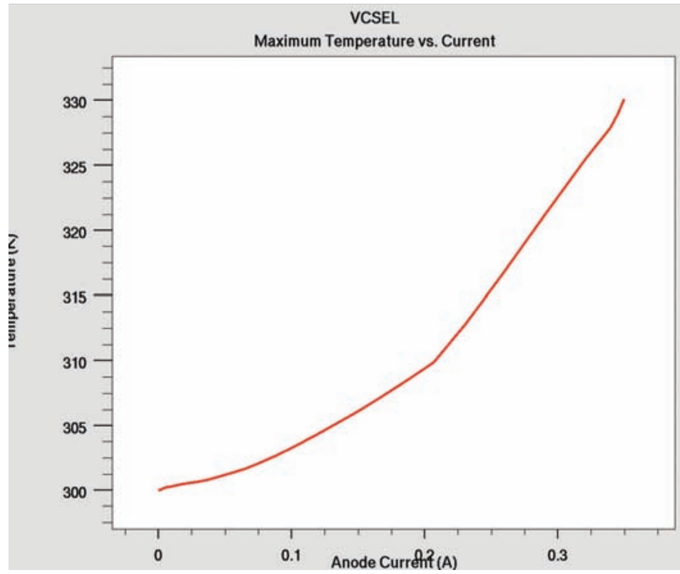


Enlarged cross-section around the quantum wells. The figure shows the radiative recombination rate in the wells. VCSEL uses accurate numerical models to predict the gain and radiative rates including the effects of quantum confinement.

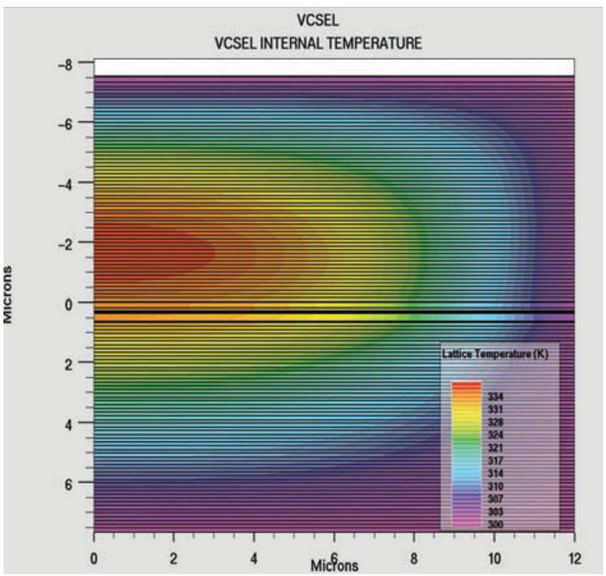
SILVACO



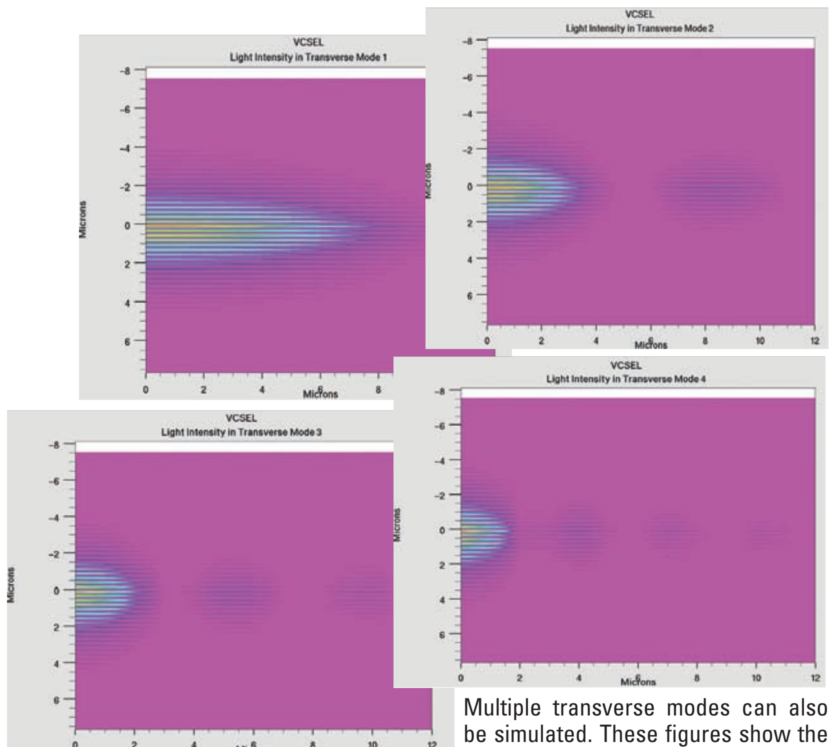
The photon rate equation is solved self-consistently with the device equations to determine the output optical intensity as a function of device bias.



The heat flow equation can also be solved self-consistently to examine the effects of self heating. In this figure we show a plot of the maximim temperature versus the device current.



Lattice temperature contours inside the VCSEL at lasing. The temperature dependence of material parameters such as refractive index are included to examine the effects of self heating on optical behavior of the VCSEL.



Multiple transverse modes can also be simulated. These figures show the optical intensity distributions for the first four transverse modes of a typical VCSEL.

SILVACO

HEADQUARTERS
4701 Patrick Henry Drive, Bldg. 2
Santa Clara, CA 95054 USA
Phone: 408-654-4309
Fax: 408-496-6080

CALIFORNIA sales@silvaco.com 408-567-1000
MASSACHUSETTS masales@silvaco.com 978-323-7901
TEXAS txsales@silvaco.com 512-418-2929

JAPAN jpsales@silvaco.com
EUROPE eusales@silvaco.com
KOREA krsales@silvaco.com
TAIWAN twsales@silvaco.com
SINGAPORE sgsales@silvaco.com

WWW.SILVACO.COM

Rev 110113_04