半导体单片集成型光源的研究

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摘要：本文首先从半导体激光器的基本原理出发，讨论了用于单片集成的不同类型的半导体激光器的特点，分析了它们目前的发展状况和未来的趋势；其中重点介绍了垂直腔面发射激光器（VCSEL）的原理及其目前的发展状况。指出决定 VCSEL 激光器性能的关键是材料和结构。然后，利用美国 National Instrument 公司的“LabVIEW”软件设计开发了一套计算 VCSEL 材料参数的程序，并可计算一般 III-V 族三元和四元化合物的能带间隙。最后对短波长和长波长 VCSEL 作了比较，并分析了 VCSEL 未来的发展趋势。

关键词：半导体激光器；集成光源；单片集成；VCSEL；程序设计

Study of Monolithically Integrated Semiconductor Lasers

Abstract: Based on principle of semiconductor laser, features of different types of monolithically integrated semiconductor lasers and their developments and trends foreground were discussed. Emphasizes were put on the vertical-cavity surface-emitted laser (VCSEL). The key features of such lasers are materials, which determine the wavelength and the gain, and structures, which determine the temperature characteristic and reflectivity of resonant cavity. In order to design a VCSEL, the program was written by using ‘LabView’ from National Instrument Company in the United States. It can calculate, for example, the energy gap and the index of refraction of the $Ga_{1-x}Al_xAs/GaAs$ with different composition, the lasing wavelength, the threshold current density and the number of DBR layers of $In_xGa_{(1-x)}As_yP_{(1-y)}/InP$ at different temperatures, and so on. At the end, by comparing VCSEL with short wavelength and that with long wavelength, future trend of VCSEL was presented.

Key Words: semiconductor laser；integrated laser source；monolithically integrated form; VCSEL；program design

教师点评：论文通过大量的资料搜集与调研，讨论了用于单片集成的不同类型的半导体激光器的特点，分析了它们目前的发展状况和未来的趋势；其中重点介绍了垂直腔面发射激光器（VCSEL）的原理及其目前的发展状况。设计开发了一套计算 VCSEL 材料参数的程序，并分析了 VCSEL 未来的发展趋势。论文内容详实，工作量大，思路流畅，条理清楚，是一篇优秀的学士论文。