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Semiconductor diode lasers for THz technology
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# CONTENT

1. Introduction .............................................. 7

2. THz Technology ........................................... 8
   2.1. THz sources .......................................... 8
   2.2. THz time domain spectroscopy ....................... 9
   2.3. THz photomixing ..................................... 10

3. Diode laser based THz technology ....................... 13
   3.1. Semiconductor diode lasers ......................... 13
   3.2. Photomixing with two colour diode lasers .......... 15
   3.3. Short pulse diode laser systems .................... 16
   3.4. Quasi Time Domain spectroscopy .................... 18

4. Summary, conclusions, and acknowledgements .......... 21

5. References .................................................. 22
1. INTRODUCTION

More or less immediately after the invention of the laser in the early 1960's, the first semiconductor lasers were realised [1,2]. After a few years the implementation of the so called double heterostructure [3] enabled operation of semiconductor diode lasers at room temperature with a small battery. From then on, there has been a rapid development introducing new semiconductor materials and new device concepts and semiconductor lasers have entered mass markets in numerous applications. The latter include optical storage (CD and DVD technology), data transmission via glass fibers for the internet, laser printing, laser scanners, material processing, scientific sensing applications, and many more. But still, there is enormous potential and further need for new developments. For example, reliable semiconductor lasers for the green spectral range [4] would be desperately needed for display applications ("laser television"), lasers with higher modulation bandwidths, for example making use of spin dynamics [5], would be desirable for the increasing optical data traffic via the internet, and powerful diode lasers would be highly desirable as compact and cost-effective alternatives for other laser systems in sensing or biomedical imaging [6,7] applications. Another emerging field of application for diode lasers is terahertz (THz) technology.

THz radiation is electromagnetic radiation with THz frequencies. In the electromagnetic spectrum, it is located in between microwaves and infrared radiation. Like other types of electromagnetic radiation, THz radiation has specific properties which make it attractive for particular applications. In detail, most package materials like paper, plastics or clothes are transparent for THz radiation. Therefore, it is extremely interesting for non destructive testing of packaged industrial goods as well for security applications. Moreover, many molecules have characteristic absorption features (so called spectral fingerprints) in the THz regime so that THz spectroscopic analysis may become a powerful tool for analysis of pharmaceutical substances or for mail inspection (search for drugs or explosives) [8,9,10].