2010

Characterization of Adsorption Processes in High-Temperature CO2 Sorbents

Daniel Faro
Casey Parker

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**Above Threshold Analysis of Quasi Guided Optical Waveguide VCSELs for Single-Mode High-Power Application**

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**Research Objectives:**
- To achieve novel vertical cavity surface emitting lasers (VCSELs) for high-power and single-mode operation.
- To demonstrate anti-guided operation of highly-injection- current VCSELs.
- To develop and complete the above threshold analysis of the QGOW VCSELs for high injection current operation.

**Proposed Solutions - Quasi-Guided Structure**

- **Quasi-guided VCSELs**
  - **Fundamental mode**
  - **Quasi-guided mode**
  - **Higher-order modes**

**Comparison of Quasi-Guided and Anti-Guided VCSELs**

- **Effective Index Model of VCSELs**
  - **Lateral Mode Profile**
  - **Core Diameter**
  - **Gain Coefficient**
  - **Diffusivity**
  - **Spontaneous Emission Factor**

**Numerical Model for 2D Lateral Mode Analysis**

- **Wave Equation (First-order differential equation)**
- **General Solution:**
- **Boundary Conditions:**
  - **2D Numerical Solution (Finite Element Method)**
  - **2D Analytical Solution (Transverse Mode Expansion)**

**Numerical Model for 2D Lateral Mode Analysis**

- **Thermal Profiling in QGOW VCSELs - Green Function Method**
- **Thermal lensing analysis of QGOW VCSELs**
  - **Injection current region**
  - **J > 2J_10**
  - **J < 2J_10**

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**Acknowledgements**