Physical Electronics

Department of Electrical and Computer Engineering

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Professor

Project 4

Due Date: November 22, 2013

**Emerging Trends in the Semiconductor Industry:**

**Design Principles and Applications of Quantum Dots (QD’s)**

Silicon (Si) semiconductors with other semiconductor materials represent a mature technology that has been studied extensively studied both experimentally and theoretically during the last four decades. Quantum dots are tunable semiconductor nano crystals that emit light at wavelengths which depends on the *size* and *composition* of the crystals. In other words they blend semiconductor electronics with photonics principles. Quantum dots are made of various materials, such as lead sulfide, cadmium silinate etc[. Typical examples of quantum dots are II-VI semi-conductors such as ZnS, CdS, ZnSe, CdSe, or CdTe and their core/shell structures, e.g. CdSe/ZnS, CdTe/CdS, or CdS/ZnS.

1. Introduce carefully the principles of quantum dots.
2. Analyze carefully designs at a system level where quantum dots have an integral role into this area. These systems may belong to different areas of science and technology such as:

optical electronics,

imaging,

optical communications,

biomedical research,

cancer detection and biomarkers,

solar cells,

LED’s, biochip designs,

MEMS, Lab-on-a Chip, ect.

You may choose one area of your interest from the above areas.

1. Analyze their engineering principles/Fabrication Techniques

iii) Characterize these materials in terms of Electrical/Optical parameters

1. Discuss the advantages and disadvantages of the candidate QD technology with respect to its peers in terms of cost/benefit/engineering value
2. Summarize carefully your conclusions. Please, present detailed reference list.

<http://www.sciencedaily.com/releases/2005/10/051021123902>.

<http://www.sandia.gov/news-center/news-releases/2003/elect-semi-sensors/quantum.html>

<https://www.llnl.gov/str/Lee.html>

Please go to the next page→

Report Guidelines: IEEE Format

Abstract: 50-100 Words *(in italic)*

1. Introduction

Introduction of the Quantum Dots

Literature Search (main body of references)

1. Problem Definition

Definition of an Area of Interest/Address Problems/needs/demand

1. Applied Methodology

Present Design Principles

Material Characterization

Systems Analysis/Procedures/Techniques

1. Discussion

Advantages Disadvantages

Comparison with peers

Applications/Potential

1. Conclusion
2. Acknowledgement
3. Reference List (IEEE Format)

Examples

[1] Richard G. Priest and Steven R. Meier, “Polarimetric microfacet scattering theory with applications to absorptive and reflective surfaces” Optical Engineering, vol. 41, pp. 988– 993, May 2002.

[2] G. C. Giakos, “Multifusion Multispectral Lightwave Polarimetric Detection Principles and Systems”, IEEE Transactions on Instrumentation and Measurement, vol. 55, no. 6, pp. 1904-1912, 2006.