SELECTED TOPICS IN ADVANCED ELECTRONICS

Edited by

Khalid A. S. Al-Khateeb

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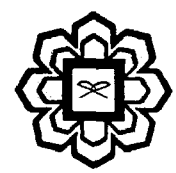

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CHAPTER 35

QUANTUM DOTS AS A SOLUTION TO RADIATION HARDNESS

By

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Synopsis

Most electronic devices nowadays are fabricated using semiconductor materials. Silicon is the most common semiconductor material used to produce devices such as MOSFET, transistor, solar cell and silicon detectors. Compared to silicon devices above, semiconductor devices made from GaAs are more resistant to radiation. This is because GaAs has a larger bandgap over silicon thus has a lower ionisation generation rate. This is one of the reasons why GaAs is widely use in radioactive environment for example in solar batteries installed in the space [1].

Great efforts are being put into designing, growing and fabricating semiconductor devices. However, the doping introduced in the semiconductor during growth process may not be the intended doping in the design of the structure. This can be due to the limitation of the growth machine such as auto-doping problem which makes it difficult to have a precise control of the doping.

Not only that, exposure to neutrons can produce measurable changes in the electrical properties and degradations of various semiconductors such as displacement damage effects and indirect ionisation [2]. Due to this reason, there is a need for radiation hardening where electronic components and systems are designed and tested resistant to damages caused by radiation [3].

A study by Beanland *et al.* [4] reported that quantum dot devices have a better resistance towards defect propagation in strained layers of a semiconductor structure as it act as barriers to dislocation movements. Quantum dot (QD) is a semiconductor crystal structure with a diameter of a few nanometers embedded in layers of