Project Draft Introduction:

**Tunneling Phenomena in Ultra-Thin Oxide MOS Structures**

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**Introduction**

Semiconductor devices have become essential components in the quickly changing field of electronics. These devices, which include integrated circuits, diodes, and transistors, have transformed contemporary electronics and opened the door for breakthroughs in a range of industries, including computing, telecommunications, healthcare, and energy. Due to their special capacity to regulate the flow of electricity in electronic devices, semiconductors have played a significant role in the development of numerous gadgets that are essential to modern life. In the current digital era, semiconductor devices can be found in everything from the microprocessor in a computer to the sensor in a digital camera. The characteristics of semiconductor materials, most frequently silicon, determine how these devices work. These materials can be changed to control the flow of electrical current and have properties halfway between those of insulators and conductors. The complicated functions of contemporary electronic devices are made possible by the development of devices that can switch and amplify electronic signals.

The unique properties of Metal-Oxide-Semiconductor (MOS) structures have attracted a lot of attention in the electronics field. High electron mobility, which enables quicker switching speeds and consequently quicker processing times, is one of the main characteristics of MOS structures. In applications where speed is crucial, like microprocessors, this is especially crucial. In addition to having a high electron mobility, MOS structures use little power. With the growing need for portable electronic devices like laptops, tablets, and smartphones in today's world, this is an essential feature. Power efficiency is important because these devices are frequently battery-operated. MOS structures are perfect for these kinds of applications because of their low power consumption, which enables longer battery life. Moreover, MOS structures and their special qualities have become more and more important as electronic devices get smaller. The production of ultra-thin oxide layers in MOS structures makes it possible to create devices that are more compact and smaller without sacrificing functionality. This has created new opportunities in the field of electronics, allowing for the creation of more potent devices that are also smaller and more portable.

The objective of this paper is to present a thorough analysis of the tunneling phenomenon in ultra-thin oxide MOS structures. When dealing with extremely thin oxide layers, the quantum mechanical phenomenon known as tunneling becomes important. The performance of MOS structures may be significantly impacted by this phenomenon, which may influence parameters like leakage current, subthreshold slope, and threshold voltage. Even with a great deal of research in this area, a thorough comprehension of the tunneling mechanisms is still elusive, particularly in ultra-thin oxide layers. This is caused in part by the complexity of quantum mechanical phenomena and the difficulties in creating and analyzing extremely thin oxide layers. Thus, the purpose of this review is to compile and evaluate the body of literature already written about this subject, point out knowledge gaps, and suggest possible directions for future research. Through this action, we aim to support the continuous endeavors to enhance the functionality of MOS structures and consequently, the electronic gadgets they drive. The methods used to study this phenomenon as well as a thorough analysis of the numerous variables influencing tunneling in MOS structures will be covered in this. To create more dependable and efficient electronic devices, the ultimate objective is to offer a thorough understanding of tunneling in ultra-thin oxide MOS structures.