

Historical Study of the Development of Transistor Structures

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Abstract:

Transistors are essential in the electrical industry as active components that enable signal amplification, fast switching, and logic processing. They replace mechanical switches and vacuum tubes, thereby reducing size, cost, and power consumption [1-3]. Transistors are semiconductors that can be used as conductors or insulators for electrical current or voltage. Several types of transistors have been discovered and developed throughout history: Planar transistors: these silicon-based transistors crystallized in a diamond structure and were doped with other impurities [4]. Junction transistors based on silicon or germanium, doped with a cubic diamond structure. MOSFET and CMOS transistors, which are also silicon- or germanium-based and share the same cubic diamond crystal structure [1,4]. Advanced gate dielectrics and high dielectric constant metal/dielectric gates have emerged. Initially, SiO₂ was used as the gate dielectric, but due to thermal degradation and current leakage, metallic gates were incorporated. Furthermore, electronics is exploring nanostructured and two-dimensional (2D) transistors, using innovative materials such as carbon nanotubes (CNT FETs), graphene (GFETs), or molybdenum disulfide (MoS₂) [5-7]. In this work, a historical study of the development of transistor structures will be presented.