Prospectus Outline

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1. **Introduction**

   (a) *The Conception of Semiconductors*

      i. Basics of semiconductors date founded on the pivotal foundations laid by 18th and 19th century physicists (e.g. Faraday and Volta) [1, 3, 12].

      ii. The term semiconductor, in the sense that it is known today, appeared in a paper by Koenigsberger in 1911 [5].

      iii. Much of the scientific community remained pessimistic towards the viability and usefulness of semiconductors up until the years following WWII [1].

      iv. Some of the theoretical framework, presenting the ideas of *instrinsic* and *extrinsic* semiconductors, were presented by Wilson (takes into account donors and acceptors) [13, 14].

      v. Post-WWII research on germanium and silicon began to shed light on the possibilities of semiconductors, for example the work by Lark-Horovitz shed light on the existence of *intrinsic* semiconductors [6, 1].

   (b) *Evolution of Semiconductors*

      i. First transistor is constructed at Bell Labs in 1947 by Shockley, Bardeen, and Brattian (device was polycrystalline germanium, shortly thereafter it was also developed using silicon) [10].

      ii. These first devices were eventually improved on by implementing single crystal materials instead of polycrystalline. This greatly improved the properties of the semiconductor device [10].

      iii. Use of diffusion process to form junctions. Allows for better control and allows for higher-frequency devices. Allows many transistors to be made on a single silicon slice, reducing cost of devices. Become commercially available in late 1950s [10].

      iv. In 1958 the first integrated circuit (IC) was demonstrated (Jack Kilby of TI), he would eventually receive the Nobel Prize in physics for this [7, 4].

      v. In the years that followed significant improvements were made. The scale of ICs grew rapidly (Moore's law) [9].

      vi. From being able to fit a few transistors on a chip in the beginning of the 1960s (small-scale integration) to present-day chips billions of transistors on one chip [2].

      vii. As growth of the semiconductor industry continued, limits on device integration and material limits of silicon and other commonly used materials are looming, causing interest in search for new materials [8, 11].

      viii. These limitations, in part, drove the increased interest in alternative materials to traditional semiconductor materials. As a result of this, widespread research has been conducted on several new materials that are renewed interest.

   (c) *Development of Two-dimensional Materials*

      i.

(d) *Current State of Two-dimensional Materials*

i.

2. **Experimental Details**

3. **Preliminary Results and Discussion**

4. **Future Works**

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