# Fabrication of $Bi_2Se_3$ thin films by vapor phase deposition for the fabrication of photodetectors based on $Bi_2Se_3$/Si junctions

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Photodetectors are used in everyday life and in scientific research, for example for medical, industrial, imaging, communication and scientific purposes.

In the field of telecommunications, long-distance signals require transmission via fiber optics due to excessive absorption and attenuation of traditional metallic conductors or coaxial cables above 1 GHz. Fiber optics, based on silicon, have transmission windows optimal at specific wavelengths, such as 1300 nm and 1550 nm, with a minimum absorption of approximately 0.3 dB/Km at 1550 nm [1].

It is necessary to develop photodetectors capable of converting the light signal into an electrical signal at the aforementioned wavelengths. Topological Insulators (TI) seem very promising, thanks to the high surface mobility and the gap of a few tens or hundreds of eV in the bulk, allowing to obtain high-responsivity devices [2].

The van der Waals crystal structure facilitates the growth of topological insulator (TI) materials on different substrates, including silicon, allowing the formation of TI/Si junctions with metal/semiconductor (Schottky) characteristics. The thin layers of TI an almost transparent window for light, allowing mostly absorbed by the silicon substrate; while by increasing the thickness of the TI, it absorbs the light, making it possible to create broadband detectors, as in the case of Bi2Se3/Si, adjustable via the thickness of the topological insulator.

In this work, we will analyze photodetectors based on Bi2Se3/n-Si heterojunctions, deposited by vapor solid deposition [3], with subsequent structural characterization by XRD and morphological by SEM and electro-optical characterizations.

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