

Introduction:

Silicon (Si) is a semiconductor that is commonly used for its ability to absorb energy in electronic and photovoltaic purposes, like solar cells. Crystal Silicon (c-Si) is mostly used for these purposes. However, there is also extensive interest in cultivating a different structure of silicon, amorphous silicon (a-Si) that has low absorption and a large energy band gap. This structure of silicon has a more disorganized structure as it is a non-crystalline, with dangling bonds. a-Si has more practical applications in optical coatings for infrared devices. Thin films of a-Si and hydrogenated a-Si (a-Si:H) are synthesized by magnetron sputtering onto a substrate, creating a silicon that has almost double the band gap of c-Si. Substrate temperature, thickness, and hydrogenation affect the band gap and absorption over a broad spectral range.

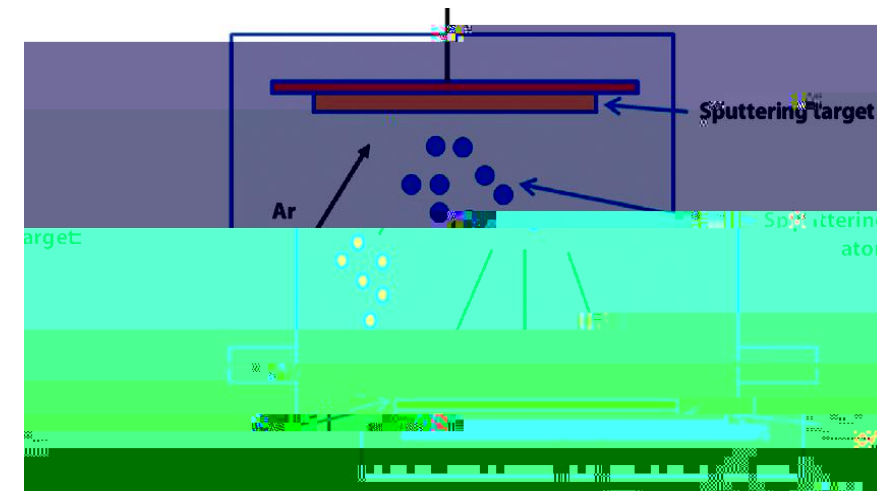
Motivation:

The goal is to use broad-band reflectance and transmittance to check if thin films of a-Si synthesized by magnetron sputtering have large energy band gaps and low absorption.

Method:

Magnetron Sputtering:

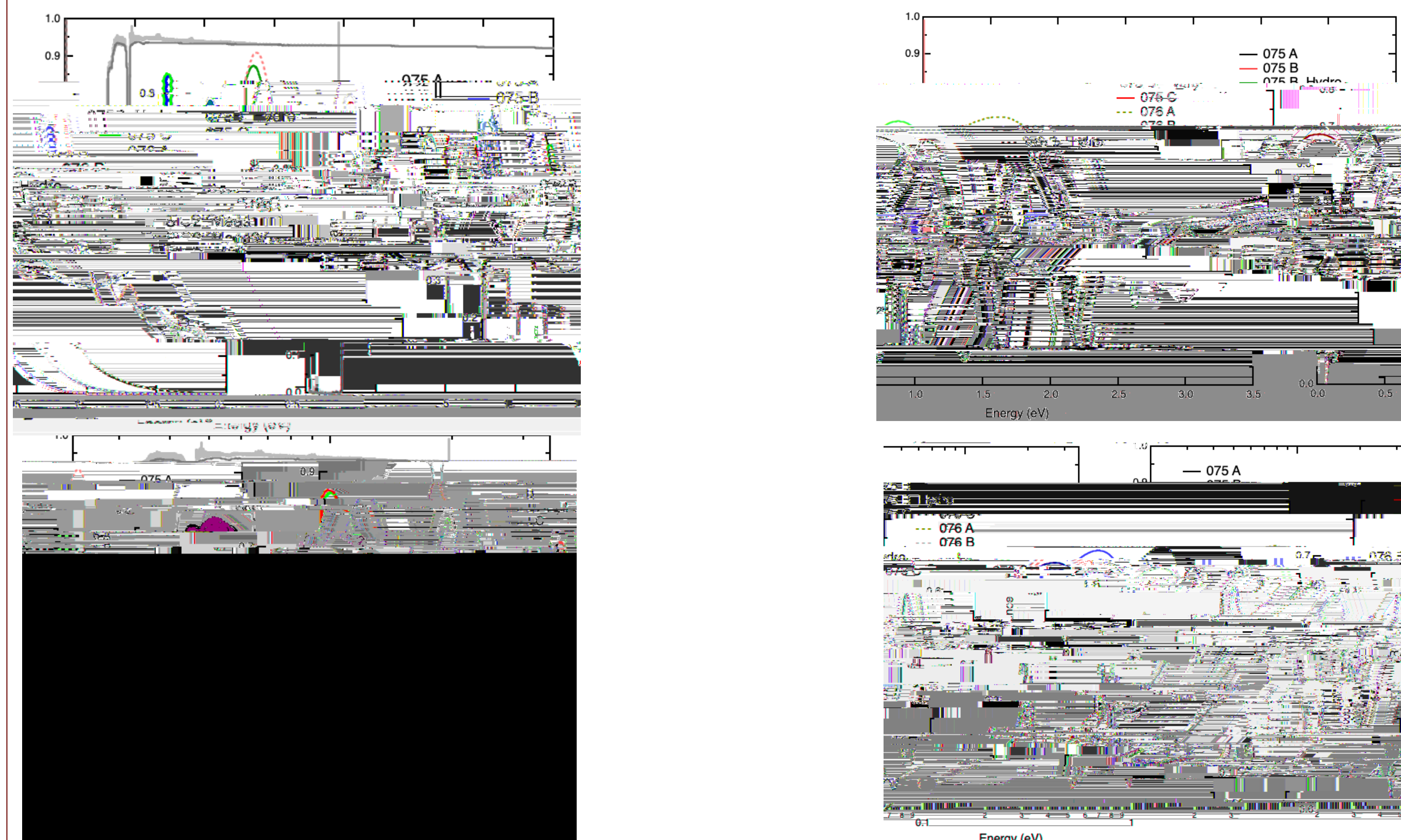
Electrons from Si target are sputtered onto substrate to grow thin films



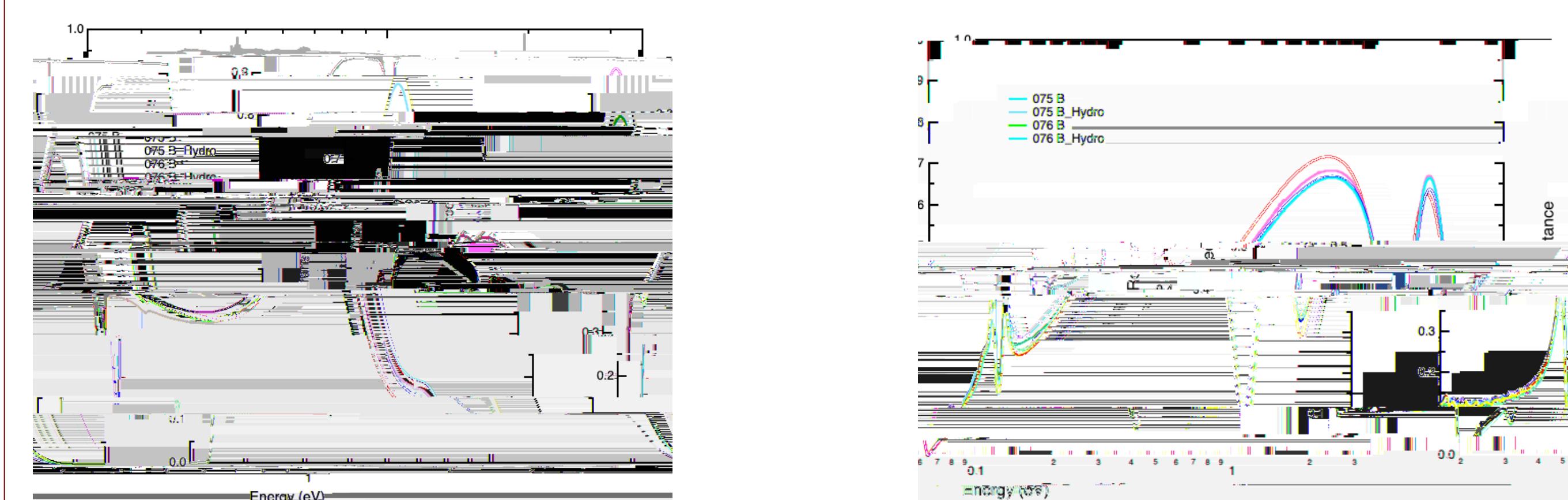
- T23-075() grown at 50 C with thicknesses:
(A) 60 nm
(B) 120 nm

Reflectance and Transmittance:

The transmittance of 075B_H and 076B_H seem have the highest transmittance levels relative to silica substrate at higher energies.



Hydrogenated films:



References:

- Kumar, Lailesh & Shrivastava, Pankaj & Panda, Deepankar & Ghosh, Arka & Syed, Nasimul. (2021).TRIBOLOGY AND CHARACTERIZATION OF SURFACE COATINGS-
- Zhou, R. (2023). Development of Amorphous-silicon-based Optical Coatings for Gravitational-wave detectors. *UC Berkeley*
- H Kang 2021 IOP Conf. Ser.:Earth Environ. Sci. 726 012001