INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student	:	Md Tarik Hossain
Roll Number	:	186121014
Programme of Study	:	Ph.D.

Thesis Title: **Study on CVD Growth of non-van der Waals 2D Bi_2O_2Se and its Hybrid Integration for Optoelectronic Applications**

Name of Thesis Supervisor(s)	:	Prof. P. K. Giri
Thesis Submitted to the Department/ ~~Center~~	:	Physics
Date of completion of Thesis Viva-Voce Exam	:	16th October 2023
Key words for description of Thesis Work	:	CVD, 2D Bi_2O_2Se, Heterostructures, Optoelectronics

SHORT ABSTRACT

This thesis focuses on investigating the CVD growth of 2D non-van der Waals Bi_2O_2Se semiconductors and their structural, optical, electrical, and thermal properties, including photodetector applications. The thermal conductivity of CVD-grown ultrathin Bi_2O_2Se layers is calculated through an optothermal Raman measurement technique. The optical properties of 2D Bi_2O_2Se are thoroughly studied on various growth substrates. We discovered room-temperature exciton formation resulting in broadband absorption and photoluminescence in ultrathin Bi_2O_2Se established through spectroscopic studies and theoretical DFT calculations. We prepared heterostructures of Bi_2O_2Se with perovskite ($CsPbBr_3$) nanocrystals as well as with 2D van der Waals type semiconductor MoS_2 and investigated the effect of charge transfer on the luminescence and photo-conducting properties of the heterostructure. A photodetector is also fabricated based on the heterojunction, and the hybrid photodetector show superior photo-responsive properties compared to the bare Bi_2O_2Se-based devices. Free-standing ultrathin nanosheets of Bi_2O_2Se are chemically synthesized for photoconductivity study that discovers defect-induced negative persistent photoconductivity in highly defective Bi_2O_2Se that can convert into positive photoconductivity through vacuum annealing. These results are important for developing non-van der Waals heterostructures for ensuing applications.