



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student : Tadasha Jena
Roll Number : 196153010

Programme of Study : Ph.D.

Thesis Title: Study on low-temperature chemical vapor deposition growth of 2D PdSe₂ for applications in surface enhanced Raman scattering and cancer biology

Name of Thesis Supervisor(s) : Prof. P.K. Giri
Thesis Submitted to the Academic Division : 13/01/2025

Date of completion of Thesis Viva-Voce Exam : 17/06/2025

Key words for description of Thesis Work : Chemical vapor deposition growth, Bilayer PdSe₂ dendrites, PdSe₂ nanoscrolls, Surface enhanced Raman spectroscopy (SERS), Cancer biology.

SHORT ABSTRACT

Palladium di-selenide (PdSe₂) has emerged as a promising two-dimensional (2D) material and serves as the primary sensing layer due to its exceptional optical properties, narrow bandgap, excellent stability, good material compatibility, and in-plane anisotropy. This thesis concentrates on studying the chemical vapor deposition growth of bilayer to multilayer PdSe₂, bilayer PdSe₂ dendrites, PdSe₂ nanoscrolls, and applications of PdSe₂ in surface-enhanced Raman spectroscopy (SERS) and in cancer biology. This work is the first to demonstrate the scrolling and unscrolling of PdSe₂ nanoscrolls in cancer cell applications, opening the great potential for a vast field of research exploring the applications of PdSe₂ nanoscrolls in cancer biology. Key focus areas include the self-driven intrinsic defects and nanopores in 2D PdSe₂ dendrites grown at low temperatures that act as hotspots for high SERS enhancement. An in-depth analysis is conducted using various experimental skills, such as catalytic growth of bilayer PdSe₂ and salt solution-assisted CVD synthesis of PdSe₂ techniques on various substrates. Furthermore, the thesis investigates chemical etchant-free transfer techniques such as H₂O-assisted and scotch-tape assisted transfer techniques for industrial applications. This thesis paves the way for the strategic use of PdSe₂ towards the next-generation SERS and advanced biosensing applications through defect engineering.