This Thesis is Dedicated to
My Beloved Parents,
Brother
&
Loved One

Declaration by the Candidate

I, **Bhupali Deka**, declare that the thesis entitled **"Studies on surface morphology, mechanical properties and exciton dynamics of nanoscale tungsten dichalcogenides emphasizing radiation effects"** is a record of my own work carried out under the supervision of **Prof. Dambarudhar Mohanta** during the period from October, 2021 to June, 2025. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree in Doctor of Philosophy at Tezpur University where no part of this thesis has previously been submitted for a degree or any other qualification at this university or any other institution.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work. I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

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Certificate by the Supervisor

This is to certify that the thesis entitled **"Studies on surface morphology, mechanical properties and exciton dynamics of nanoscale tungsten dichalcogenides emphasizing radiation effects"**, submitted to the School of Sciences, Tezpur University in partial fulfilment for the award of the degree of **Doctor of Philosophy** in Physics is a record of original research work carried out by **Ms. Bhupali Deka** under my supervision and guidance.

All help received by her from various sources has been duly acknowledged. No part of this thesis has been submitted elsewhere for the award of any other degree.

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List of Abbreviations

0D	Zero dimensional
1D	One dimensional
2D	Two dimensional
3D	Three dimensional
kGy	Kilo gray
FE-SEM	Field emission scanning electron microscopy
EDX	Energy dispersive X-ray
nm	nanometer
μm	micrometer
mW	milliwatt
FWHM	Full width at half maxima
BET	Brunauer-Emmett-Teller
BJH	Barrett-Joyner-Halenda
UTM	Universal Testing Machine
UV	Ultraviolet
PL	Photoluminescence
TRPL	Time-resolved photoluminescence
D-H	Dollimore-Heal
HK	Horvath-Kawazoe
N	Nitrogen
Vs.	Versus
XRD	X-ray diffraction
HR-TEM	High-resolution transmission electron microscopy
XPS	X-ray photoelectron spectroscopy
AFM	Atomic force microscopy
IF	In-organic fullerene
FFT	Fast Fourier transform
SAED	Selected area electron diffraction
C-dot	Carbon-dot
LA	Longitudinal acoustic
WC	Tungsten carbide

W	Tungsten
S	Sulfur
VBM	Valence band maxima
CBM	Conduction band minima
BZ	Brillouin zone
SC	Semiconductor
DOS	Density of states
PDOS	Projected density of states
eV	Electron volt
DFT	Density Functional Theory

List of Symbols

β	Beta
γ	Gamma
λ	Wavelength
Γ	Full-width half maxima
θ	Theta
d_c	Crystallite size
ε	Micro strain
Å	Angstrom
I	Current
t	Time
ϕ	Ion fluence
n	Charge state
q	Electronic charge
A	Area
τ_{av}	Exciton lifetime
μ	micro
λ_{ex}	Excitation wavelength
K	Consistency index
m	Power index
η	Viscosity
τ	Shear stress
$\dot{\gamma}$	Shear rate
h	Planck’s constant
c	Speed of light
ΔE	Phonon mode energy