Declaration

I hereby declare that the work presented in this thesis titled *Chemical Vapor Deposition Grown MoS_2 for Sensing Applications* submitted to the Indian Institute of Technology Jodhpur in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy, is a bonafide record of the research work carried out under the supervision of Dr Mahesh Kumar. The contents of this thesis are full or in parts, have not been submitted to, and will not be submitted by me to, any other institute or university in India or abroad for award of any degree or diploma.

Rahul

Rahul Kumar
P15EE203

Certificate

This is to certify that the thesis titled *Chemical Vapor Deposition Grown* MoS_2 *for Sensing Applications*, submitted by *Rahul Kumar* (P15EE203) to the Indian Institute of Technology Jodhpur for the award of the degree of *Doctor of Philosophy*, is a bonafide record of the research work done by him under my supervision. To the best my knowledge, the contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

Dr. Mahesh Kumar
Ph.D thesis Supervisor

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Rahul Kumar
Ph.D. Student

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List of Symbols

Symbol	*Description*
θ	Angle of incident
A	Area
E_g	Bandgap energy
Φ_B	Barrier height
k	Boltzmann constant
V_{bi}	Build-in potential
ΔI	Change in current
ΔR	Change in resistance
ΔV	Change in voltage
ΔE_c	Conduction band offset
I_a or I_o	Current in air
I_g	Current in the target gas
E_c	Conduction band energy
τ_d	Decay time
I_d	Dark Current
D*	Detectivity of photodetector
W	Depletion width
q	Electron charge
G	Electron conduction
χ	Electron effinity
μ	Electron mobility
$q\,\varphi_r$	Energy difference in conduction band and Fermi level
υ	Frequency
η	Ideality factor
P_i	Input power
c	Lattice constant
l	Length
Φ_m	Metal work function
T	Operating temperature
h	Plank constant
I_p	Photocurrent
n	Power coefficient
S	Relative response
R_a	Resistance in air
R_g	Resistance in the target gas
R	Responsivity of photodetector
A*	Richardson constant
τ_r	Rise time
Ev	Valance band energy
ΔE_v	Valance band offset
V_a	Voltage in air
V_g	Voltage in the target gas
λ	Wavelength
W	Watt

List of Abbreviations

Abbreviation	*Full form*
AFM	Atomic force microscopy
BE	Binding energy
CL	Cathodoluminescence
CVD	Chemical vapor deposition
I-V	Current-voltage
D	Dimentional
DFT	Density functional theory
FESEM	Field emission scanning electron microscopy
FWHM	Full-width half maxima
FET	Field-effect transistor
HA	Horizontally aligned
IoT	Internet of Things
LED	Light-emitting diode
LDL	Low detection limit
MFC	Mass flow controller
MOCVD	Metal-organic chemical vapour deposition
Mo	Molybdenum
MoS_2	Molybdenum disulfide
NR	Nanorod
NW	Nanowire
1D	One-dimensional
PL	Photoluminescence
PVD	Physical vapour deposition
ppm	Parts per million
ppb	Parts per billion
RF	Radiofrequency
rGO	Reduced graphene oxide
RMS	Root mean square
RT	Room temperature
RH	Relative humidity
SAED	Selected area electron diffraction
SEM	Scanning electron microscopy
S	Sulfur
Sv	Sulfur vacancy
SCCM	Standard cubic centimetres per minute
TE	Thermionic emission
2D	Two-dimensional
3D	Three-dimensional
TMDCs	Transition metal di-chalcogenides
TEM	Transmission electron microscopy
Uv-Vis	Ultraviolet- visible
VOC	Volatile organic compound
VA	Vertically aligned
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction
0D	Zero-dimensional