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(Prof. S. Jit)
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I, Smrity Ratan, certify that the work embodied in this thesis is my bonafide work and carried out by me under the supervision of Prof. S. Jit for five years and six months from "23/07/2015" to “27/01/2021”, at the Department of Electronics Engineering, Indian Institute of Technology (BHU), Varanasi. The matter embodied in this thesis has not been submitted for the award of any other degree/diploma. I declare that I have faithfully acknowledged and given credits to the research workers wherever their works have been cited in my work in this thesis. I further declare that I have not willfully copied any other's work, paragraphs, text, data, results, *etc*., reported in journals, books, magazines, reports, dissertations, theses, *etc*., or available at websites and have not included them in this thesis and have not cited as my work.

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Date: **(Smrity Ratan)**

Dedicated To my Beloved Parents...
My wife Parul and my daughter Yamini

Whose blessings, love and sacrifice brought me here up to.....

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LIST OF ABBREVIATIONS

Abbreviation	Details
FETs	Field-effect transistors
BJT	Bipolar junction transistor
MOSFET	Metal oxide semiconductor field-effect transistor
TFT	Thin film transistor
TFs	Thin film
EBE	Electron beam evaporation
NMs	Nanomaterials
C_3H_8O	Isopropyl alcohol
p-Si	P-type silicon
HCL	Hydrochloric acid
SG	Sol-gel
PVDF	Polyvinylidene fluoride
DI	Deionized water
H_2SO_4	Sulfuric acid
H_2O_2	Hydrogen peroxide
MFC	Mass flow controller
CuO	Cupric oxide
Cr_2O_3	Chromium oxide
AFM	Atomic force microscopy
SEM	Scanning electron microscopy
EDX or EDS	Energy dispersive X-ray spectroscopy
TEM	Transmission electron microscopy
XRD	X-ray diffraction
nm	Nanometre
MSM	Metal-semiconductor-metal

MOS	Metal-oxide-semiconductor
SPA	Semiconductor parameter analyser
HF	Hydrogen fluoride
E-nose	Electronic nose
MIS	Metal-insulator-semiconductor
RH	Relative humidity
RT	Room temperature
TiO_2	Titanium dioxide
ZnO	Zinc oxide
CdSe	Cadmium selenide
QDs	Quantum Dots
SnO_2	Tin oxide
µm	Micrometer
NO_2	Nitrogen dioxide
Au	Gold
Ag	Silver
Pd	Palladium
Al	Aluminum
Pt	Platinum
Ti	Titanium
RMS	Root mean square
Si	Silicon
SiO_2	Silicon dioxide
n-Si	N-type Silicon
ppm	Part per million
ppb	Part per billion
CO	Carbon monoxide
CO_2	Carbon dioxide
SOI	Silicon-on-insulator

CMOS	Complementary metal-oxide-semiconductor
H_2	Hydrogen gas
N_2	Nitrogen gas
rpm	Revolution per minutes

LIST OF SYMBOLS

Symbol	Details
λ	Wavelength
θ	Diffraction angle
L	Liter
ml	milliliter
e	Charge of electron
C-V	Capacitance-Voltage
I-V	Current-voltage
G-V	Conductance-voltage
I_{air}	Sensor current wihtout gas exposure
I_{H2}	Sensor current under gas exposure
S	Gas response
n	integer
$0D$	Zero dimensional
$1D$	One dimensional
$2D$	Two dimensional
$3D$	Three dimensional
d	interplanar spacing
^{o}C	degree Celsius
K	Temperature in Kelvin
V	Voltage
I	Current
C	Capacitance
G	Conductance

q	Charge of electron
C_i	Gate-oxide capacitance
ΔC	Change in capacitance
ΔG	Change in conductance
T_{res}	Response time
T_{rec}	Recovery time
V_{FB}	Flat band voltage
Q_{SS}	Surface charge density
φ_{ms}	Work function difference