List of Abbreviations

TMO	Transition metal oxide
SMO	Semi-conductor metal oxide
Cu	Copper
CuO_x	Copper oxide
Cu_2O	Cuprous oxide
CuO	Cupric oxide
Zn	Zinc
ZnO	Zinc oxide
TiO_2	Titanium dioxide
SnO_2	Tin dioxide
Bi_2O_3	Bismuth trioxide
NiO	Nickel (II) Oxide
Ta	Tantalum
Mo	Molybdenum
W	Tungsten
Ag	Silver
Ti	Titanium
CO	Carbon monoxide
He	Helium
O_2	Oxygen
Ar	Argen
N_2	Nitrogen
MB	Methylene blue
HH	Hydrogen Hydrate
RT	Room Temperature
RF	Radio Frequency
DC	Direct Current
PVD	Physical vapor deposition
CVD	Chemical vapour deposition
PLD	Pulsed laser deposition
MBE	Molecular beam epitaxy

XRD	X-ray diffraction
SEM	Scanning electron microscopy
XPS	X-ray photoemission spectroscopy
UV-Vis	Ultraviolet-visible
AFM	Atomic force microscopy
STM	Scanning tunneling microscopy
XPS	X -ray photoemission spectroscopy
EDS	Energy dispersive Spectroscopy
SPSTM	Spin polarized scanning tunneling microscope
BEEM	Ballistic electron emission microscope
SFEM	Scanning field emission microscope
PSPD	Position sensitive photo-detector
PID	Proportional–integral–derivative
DMHCS	Disordered mesoporous carbon spheres
LED	Light emitting diodes
US-NIOSH	United States National Institute of Occupational Safety and Health
PQMS	Physical quantity measurement system
JCPDS	Joint Committee on Powder Diffraction Standards
FWHM	Full-width half maximum
VB	Valance Band
CB	Conduction Band
CZO	Zn doped CuO
ZnO:Cu	Cu doped ZnO
VOCs	Volatile Organic Compounds

List of Symbols

Λ	Mean free path
R	Source substrate distance
T	Source temperature
P	Evaporant vapor pressure
P	Chamber pressure
M	Molecular mass of evaporant
R_s	Sheet Resistance
I	Current
V	Voltage drop
CF	Correction factor
F_1	Thickness correction factor
F_2	Geometric dimension
F_3	Edge correction factor
s	Probe spacing
d	Width of the sample
l	Length of the sample
t	Thickness of the sample
n	Carrier concentration
μ	Carrier mobility
λ	Wavelength
θ	Bragg angle
D	Crystallite size
ε	Micro strain
δ	Dislocation density
β	Full width half maximum
ρ	Electrical resistivity
σ	Electrical conductivity
$F(R)$	Kubelka - Munk formula
T	Transmittance
I	Transmitted intensity
I_o	Incident intensity of the light

A	Absorbance
α	Absorption coefficient
R	Reflectance
ν	Frequency
h	Planck's constant
$h\nu$	Photon energy
E_b	Binding Energy
E_k	Kinetic energy
Φ	Work function
ΔE	Activation energy
ΔG	Energy change for chemical reaction
ΔH	Changes in Enthalpy
ΔS	Changes in Entropy
D	Diffusion coefficient of the oxidizing species
F_1	Diffusive flux
C_0	Concentration of the oxidizing species in atmosphere to film surface
C_s	Concentration of the oxidizing species at the $Cu\text{-}Cu_2O$ interface
x	Thickness of the oxide layer
F_2	Reactive flux
K	Reaction rate
S	Sensitivity
R_a	Sensor resistances in air ambient
R_g	Sensor resistances in target gas
C	Concentration of the target gas
e^-	Electron
h^+	Hole

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Flow Chart I

Semi-conductors Metal Oxide (SMO)

Preparation

Physical Route under Vacuum

Thermal evaporation

Sputtering

RF/DC Sputtering

Oxidation

Electrical

Structural

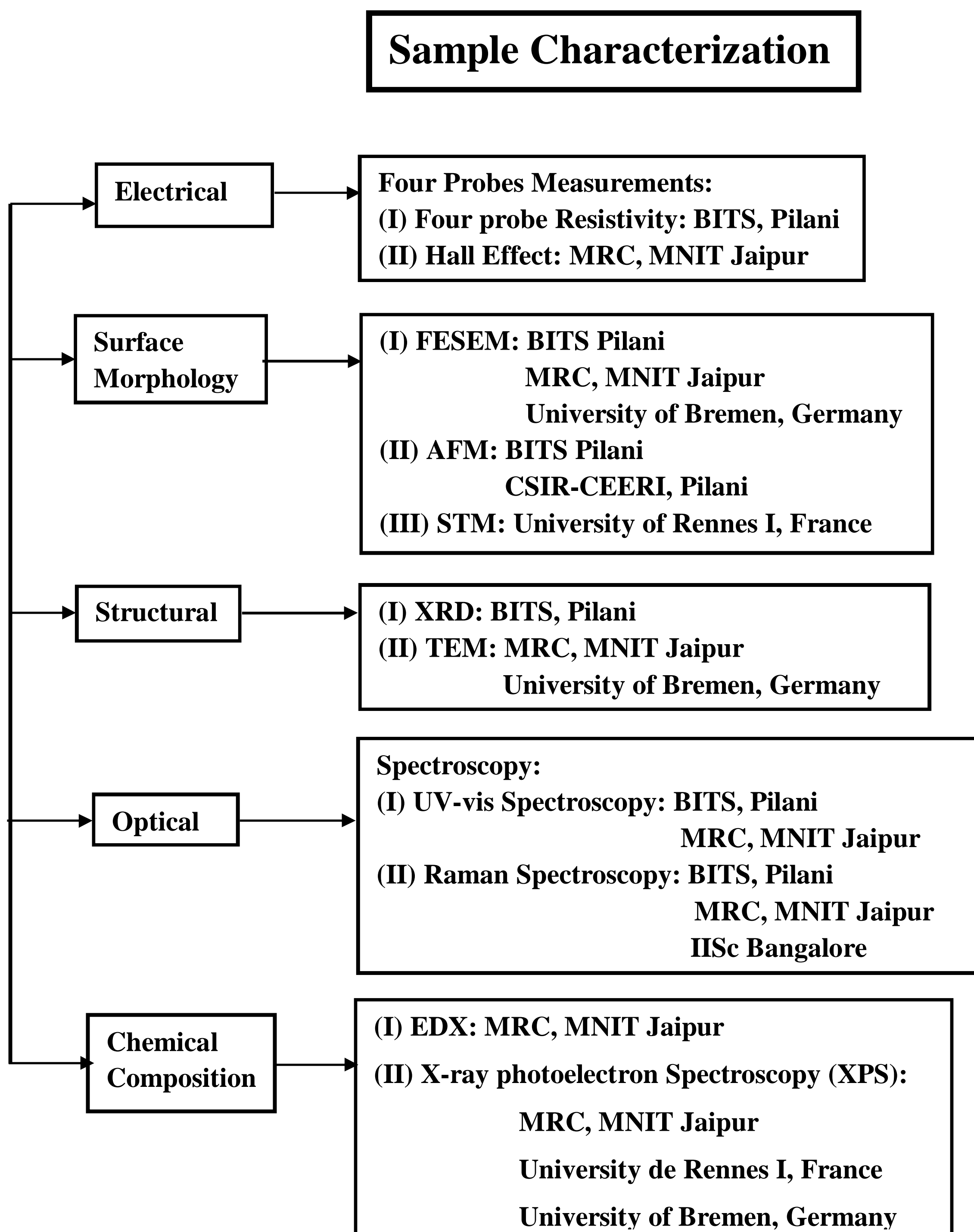
Optical

Chemical

Surface Morphology

Applications

Flow Chart II



Flow Chart III