

1. Synthesis and Processing

ageing
annealing
anodization
atomization
blending
bonding
Casting
Coating
cold working
combustion synthesis
Crystal Growth
 Bridgman technique
 Czochralski technique
Deposition
 chemical vapor deposition (CVD)
 laser deposition
 molecular beam epitaxy (MBE)
 physical vapor deposition (PVD)
 sputtering
dynamic compaction
electron beam methods
electroplating
foaming
Forming Processes
 cold isostatic pressing (CIP)
 deep drawing
 drawing
 extrusion
 forging
 hot isostatic pressing (HIP)
 hot pressing
 rolling
 solid freeform processes
galvanisation
high-speed deformation
homogenisation/solutionisation
hot working
implantation
Infiltration
 liquid infiltration
 vapour infiltration
slurry infiltration
injection moulding
ion-beam processing
Isothermal heat treatments
 austempering
 martempering
Joining
 brazing
 diffusion bonding
 friction stir welding
 soldering
 welding
Laser Treatment
 laser annealing
 laser deposition
 laser welding
liquid phase sintering
liquid phase epitaxy (LPE)
lithography
mechanical alloying
mechanical milling
melt spinning
metal injection moulding (MIM)
mineralization
processing
plasma spraying
plating
photochemical processing
powder consolidation
powder metallurgy (PM)
powder processing
quenching
reactive ion etching
recycling
self-propagating high-temperature synthesis (SHS)
semi-solid processing
Severe Plastic Deformation (SPD)
 accumulative roll bonding (ARB)
 equal channel angular extrusion (ECAE)
 equal channel angular pressing (ECAP)
 equal channel angular pressing – back
 pressure (ECAP-BP)
 equal channel angular rolling (ECAR)
 friction
 high pressure torsion
 torsion
sintering
sol-gel
Solidification
 directional solidification
 eutectic solidification
 solidification microstructure
 monotectic solidification
 multicomponent solidification
 peritectic solidification
 rapid solidification
 spin-coating
splat quenching
sputtering
strain ageing
surface alloying
tempering
thermomechanical processing
thin films
tissue engineering

2. Characterization

acoustic methods
atom locating by channeling enhanced microanalysis (ALCHEMIE)
Brillouin scattering
critical exponent analysis
deep level transient spectroscopy (DLTS)
differential scanning calorimetry (DSC)
differential thermal analysis (DTA)
dynamic mechanical analysis
electrical resistivity/conductivity
ellipsometry
image analysis
ion microprobe (WDXS)
Kerr-Faraday-magnetometry
Mechanical Properties Testing
 bending test
 compression test
 creep test
 fatigue test
 hardness test
 high cycle fatigue
 impact test
 low cycle fatigue
 microindentation
 nanoindentation
 scratch test
 tension test
 toughness
Microscopy and Microanalysis Techniques
 analytical electron microscopy
 atomic force microscopy (AFM)
 atom-probe field-ion microscopy (AP-FIM)
 convergent beam electron diffraction
(CBED)
 electron backscattering thermogravimetric analysis
 electron backscattering diffraction (EBSD)
 electron diffraction
 electron energy loss spectroscopy (EELS)
 electron holography
 electron probe microanalysis (EPMA)
 energy dispersive x.-ray spectroscopy
(EDXS)
 energy filtering transmission electron microscopy
 field-ion microscopy (FIM)
 high angle annular dark field (HAADF)
 high-resolution electron microscopy
(HREM)
 Lorenz microscopy
 magnetic force microscopy (MFM)
 orientation imaging microscopy (OIM)
 scanning electron microscopy (SEM)
 scanning/transmission electron microscopy
(STEM)

scanning tunnelling microscopy (STM)
transmission electron microscopy (TEM)
three-dimensional atom probe (3DAP)
3D X-ray microscopy
tomographic atom probe (TAP)
wave-length dispersive X-ray spectroscopy
Z-contrast microscopy
Mössbauer spectroscopy
nuclear magnetic resonance (NMR)
nuclear reaction analysis
positron annihilation (PAL)
radiography
Rutherford backscattering (RBS)
Surface Analysis Techniques
 Auger electron spectroscopy (AES)
 ion scattering spectroscopy (ISS)
 Infrared (IR) spectroscopy
 low energy electron diffraction (LEED)
 optical spectroscopy
 Raman spectroscopy
 reflection high-energy electron diffraction (RHEED)
 secondary ion mass spectroscopy (SIMS)
 x-ray photoelectron spectroscopy (XPS)
thermally stimulated acoustic methods
thermogravimetric analysis
X-ray and Neutron Techniques
 extended X-ray absorption fine structure (EXAFS, XANES)
 neutron diffraction
 small angle neutron scattering (SANS)
 small angle x-ray scattering (SAXS)
 synchrotron radiation
 x-ray diffraction (XRD)
 x-ray pole figures
 (EFTEM) x-ray fluorescence

3. Material Type

Amorphous Materials

- bulk amorphous materials
- liquids
- metallic glasses
- non-metallic glasses (silicates)
- polymers

Biomaterials

- bone
- hydroxyapatite
- polymeric biomaterials

beryllides

borides

carbides

carbon & graphite

cellular materials

ceramics

cermets

Composites

- ceramic matrix composites (CMC)
- fiber reinforced composites
- soft magnitic composites (SMC)
- metal matrix composites (MMC)
- particulate reinforced composites
- polymer matrix composites
- whisker reinforced composites

Compounds

- intercalation compounds
- intermetallic compounds
- ionic compounds
- semiconductor compounds

dielectrics

electroceramics

fibers

foams

functionally graded materials (FGM)

fuel cell materials

fullerenes and related materials

granular materials

insulators

Intermetallics

- iron aluminides
- nickel aluminides
- niobium aluminides
- titanium aluminides
- transition metal silicides

Heusler alloys

hydrides

Laves phases

layered structures

liquids

liquid crystals

macromolecular materials

materials with reduced dimensions

Metal & Alloys

alkaline earth

aluminium

aluminium alloys

copper

copper alloys

iron

iron alloys

magnesium

magnesium alloys

nickel

nickel alloys

platinum-group

rare earth

refractory metals

semiconductor

steels

titanium

titanium alloys

transition metals

minerals

multilayers

nanocomposite

nanocrystalline materials

nitrides

optical materials

Oxides

amorphous oxides

binary oxides

crystalline oxides

non-binary oxides

perovskites

Polymers

amorphous polymers

copolymers

elastomeric polymers

electrical conductivity of

flow properties of

melts and solutions of

physical properties of

structure of

thin polymer films

porous material

powder material

admixed

lean

prealloyed

quasicrystals

Semiconductors

amorphous semiconductors

compound semiconductors

elemental semiconductors

semiconductor devices

semimetals

shape memory alloys (SMA)

silicides

solid electrolytes

Steels

- austenitic steels
- bainitic steels
- carbides
- dual phases
- ferritic steels
- heat resistant steels
- high strength low alloy (HSLA) steels
- interstitial free (IF) steels
- maraging steels
- martensitic steels
- pearlitic steels
- stainless steels

Superconductors

- ceramic superconductors
- organic superconductors
- metallic superconductors

Thin Films

- coatings
- magnetic recording thin films
- magnetic thin films
- multilayer thin films

whiskers

zeolites

4. Properties and Phenomena

- acoustic properties
- adhesion
- buckling
- capillary phenomena
- catalysis
- cellular growth
- coarsening
- convection
- corrosion
- crystallization
- crystal growth
- crystal structure
- damping
- Decomposition
- ordering decomposition
- spinodal decomposition
- deformation structure
- deformation inhomogeneities
- deformation texture
- dendritic growth
- dielectric loss and relaxation
- Diffusion
- bulk diffusion
- diffusion in liquids
- grain boundary diffusion
- interface diffusion
- interdiffusion
- interstitial diffusion
- ionic diffusion
- multicomponent
- short circuit diffusion
- substitutional diffusion
- surface diffusion
- diffusion-induced grain boundary motion (DIGM)
- Dislocation
- dislocation boundaries
- dislocation dynamics
- dislocation mobility
- dislocation structure
- dislocation theory
- disorientation
- dynamic phenomena
- electrical properties
- electrochemistry
- electronic structure
- Embrittlement
- grain boundary embrittlement
- hydrogen embrittlement
- liquid metal embrittlement
- ferroelectricity
- Grain Boundaries
- coincidence site lattice (CSL)
- coincidence boundaries
- grain boundary cohesion
- grain boundary defects

grain boundary diffusion
grain boundary embrittlement
grain boundary energy
grain boundary grooving
grain boundary junctions
grain boundary migration
grain boundary segregation
grain boundary structure
twin grain boundary
grain boundary wetting
grain refining
Grain Growth
normal grain growth
abnormal grain growth
secondary recrystallization
tertiary recrystallization
grain growth texture
Goss texture
Grain size
Grain morphology
Hydrogen
hydrogen absorption
hydrogen desorption
hydrogen diffusion
hydrogen embrittlement
hydrogen storage
Interfaces
interface antiphase
interface defects
interface dynamics
interface migration
interface structure
interface wetting
interlayer exchange coupling
internal friction
internal stresses
Lattice Defects
disclinations
dislocations
faults
interfaces
interstitials
point defects
vacancies
Magnetic Properties
coercivity
colossal magnetoresistance
exchange interaction
giant magneto resistance (GMR)
hard magnets
magnetic anisotropy
magnetic domain
magnetic recording
magnetic structure
magnetoresistance
magnetostriction

tunnel magnetoresistance
soft magnets
spin glass
Mechanical Properties
Bauschinger effect
brittle-to-ductile transition
creep
dynamic strain aging
ductility
elastic behaviour
erosion
fatigue
fracture
hardness
high temperature deformation
impact behaviour
low temperature deformation
mechanical spectroscopy
plastic deformation
Portevin-Le Chetelier effect
shear bands
slip
strain aging
strain path change
stress-rupture
superplasticity
thermally activated processes
toughness
twinning
yield phenomena
mesostructure
metastable phases
Microstructure
equiaxed microstructure
nanocrystalline microstructure
polyphase microstructure
recrystallized microstructure
ultrafine grained microstructure
misorientation
nanostructure
non-destructive testing
Optical Properties
electro-optical effects
optical activity & birefringence
optical absorption
optical emissivity
optical reflectivity
optical transmission
photoelastic effects
photorefractive effects
Ordering
continuous ordering
long range ordering
short range ordering
oxidation
percolation

Phase Transformations
crystallization
heterogeneous nucleation of phase transformations
homogeneous nucleation of phase transformations
martensitic phase transformation
massive phase transformation
nucleation and growth
ordering
order-disorder phenomena
phase separation
phase transformation kinetics
polymorphic phase transformation
spinoidal decomposition
piezoelectricity
plasma material interaction
precipitation
radiation effects
Recovery
abnormal subgrain growth
annihilation
subgrain coalescence
subgrain growth
Recrystallization
continuous recrystallization
discontinuous recrystallization
dynamic recrystallization
nucleation of recrystallization
particle stimulated nucleation (PSN)
primary recrystallization
recrystallization kinetics
recrystallization texture
secondary recrystallization
tertiary recrystallization
static recrystallization
reduced dimensions
residual stresses
Segregation
interface segregation
surface segregation
stress migration
Solidification
directional solidification
eutectic solidification
kinetic solidification
monotectic solidification
multicomponent solidification
peritectic solidification
rapid solidification
undercooling solidification
superlattice
Surface
surface energy
surface diffusion
surface segregation
surface structure

texture
thermal conductivity
tribology
twinning
undercooling
wear
wetting

5. Theory, Computer Simulations and Modeling

ab-initio electron theory
analytical methods
atomic potentials
Avrami-Johnson-Mehl-Kolmogorov theory (JMAK)
CALPHAD
constitutive equations
continuum mechanics
density functional theory (DFT)
electronic structure
finite element modeling (FEM)
finite difference modelling (FDM)
finite volume modelling (FVM)
first-principle electron theory
full-potential calculations
homogenisation
kinetics self-organization & patterning
lattice Boltzmann model
local density approximations (LDA)
Micromechanical Modeling
finite element analysis (FEA)
mean field analysis
strain gradient plasticity
dislocation theory
work hardening modeling
dislocation statistics
dislocation dynamics
cellular automaton
cluster variation method
molecular dynamics simulations (MD-simulations)
molecular statics simulations
augmented plane wave method (FLAPW)
Monte Carlo simulations (MC-simulations)
non-equilibrium processes
phase field modeling
statistical mechanics
Texture modelling
Taylor models
Viscoplastic self consistent models (VPSC)
Grain Interaction Models
thermodynamics
total energy calculations
Vertex models