

## 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 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)

    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 micro-analysis (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
- 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

#### 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 Chatelier 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
- spinodal 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 (~~FL~~APW)
- 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