The Department of Materials Engineering (MTM) is performing and teaching groundbreaking materials research, and is currently active in the fields of advanced alloys and production processes, ceramics, nanomaterials, high temperature processing of liquid metals, intermetallics, polymers and composites, thermodynamics, deformation processing, materials performance and degradation, non-destructive testing, surface engineering, biomaterials, alloys for 3D-printing and modelling of materials and processes.

A flexible organisation allows tackling scientific and industrial problems in a multidisciplinary way. MTM organises a Dutch and an international Master of Materials Engineering programme.

www.mtm.kuleuven.be/Onderwijs
(Dutch programme)
www.mtm.kuleuven.be/English/Education
(international programme)

Research Profile

The Department of Materials Engineering (MTM) focuses on research in materials science, balancing fundamental and applied research under the umbrella of sustainability. MTM has a multi-cultural and international profile, currently representing over 30 nationalities. Important values are relevance for society, continuity and trust and confidentiality in long-term-cooperation with strong industrial and societal partners.

Keywords

Materials
metals • intermetallics • ceramics • polymer based composites • porous materials • biomaterials • refractory materials • textiles • cellular materials • coatings • alloys for additive manufacturing • thin films • functionally graded materials • shape memory alloys • nanomaterials and nanocomposites

Characterisation
microstructural, micro-analytical and mechanical characterisation • tribochemistry • corrosion • fatigue • non-destructive testing • friction and wear

Processing
solidification • powder metallurgy • metal forming • sintering • electrochemistry • aqueous and non-aqueous electrodeposition • wetting phenomena • conversion layers • electrophoretic deposition • high temperature processing of liquid metals • valorisation of waste streams in high-temperature metallurgical processes

Modelling
thermodynamics • kinetics • phase field and lattice Boltzmann methods • multi-scale modelling of mechanical behaviour of metals - forming - FEM of metals • textiles and composites • molecular dynamics • molecular kinetics

Divisions

There are four divisions at MTM, each of them covering different research lines and topics.

• Surface and Interface Engineered Materials (SIEM)
• Structural Composites and Alloys, Integrity and Non-destructive Testing (SCALINT)
• Sustainable Metals Processing and Recycling (SeMPeR)
• Materials Technology Cluster (TC)
Unique Infrastructure

Characterisation:
Electrochemical techniques, thermal analysis measurements, physical properties (elastic properties, internal friction), electron microscopy (TEM, ESEM, dual-beam SEM-FIB, FEG-SEM, EBSD/OIM, EPMA), confocal scanning laser microscopy, X-ray radiography diffraction including texture measurement, suspension characterisation equipment, non-destructive testing (AE, microfocus X-ray radiography, micro- and nano-CT, acousto-optic technique, optical fibres for damage detection, high-frequency ultrasonic C-scan), friction and wear test rigs, nano-indentation and contact less surface roughness techniques, full range of tensile, bending and fatigue test equipment (with in-situ strain mapping), instrumented impact testing, etc.

Processing:
Equal Channel Angular Extrusion (ECAE), high temperature processing of metals, microwave and spark plasma sintering, hot pressing, electrochemical transient techniques, lab-scale composite manufacturing (prepreggers, autoclave, compression moulding, etc.), powder metallurgy (gas atomisation, CIP), materials processing in strong magnetic fields, etc.

Modelling:
Home-made software for analysis and simulation of textiles and textile composites (WiseTex, LamTex, FlowTex, TexComp, VoxTex), commercially available thermodynamic software (ThermoCalc, FactSage, Dictra, ChemApp), finite element codes, home-made software for quantitative texture analysis, phase field models, lattice Boltzmann models, etc.

Facilities:
See www.mtm.kuleuven.be/English/ResearchGroups/Equipment/List

Collaboration and Users

MTM is by far the largest department of its kind in Belgium. MTM is the driving force behind the KU Leuven Materials Research Centre (LMRC), is one of the main partners in EIT Raw Materials, is active in European framework programmes and collaborates with IMEC and universities and industries worldwide.

Research funding of MTM is provided mainly by the Research Council of KU Leuven and the Research Foundation Flanders (FWO, fundamental research), IWT-VLAIO and SIM (applied research jointly with Flemish industries) and international research programmes, including European FP7 and Horizon 2020 programs such as the Marie Curie PEOPLE programme, the European Research Council (ERC), EIT Raw Materials and various COST actions, and the M2i-Institute in The Netherlands. MTM also intensively cooperates with many research institutes and with the Belgian and European industry. Bilateral collaborations and direct industrial funding with companies is organised through LRD-KU Leuven.

Spin-offs

EconCore aims to commercialise innovative lightweight sandwich materials with honeycomb core structures for structural applications in the automotive, furniture and building industry and packaging applications.
www.econcore.com

Falex Tribology N.V. offers standardised tribological test equipment on friction, wear and tribocorrosion, consulting, and testing, in support of industrial developments.
www.falexint.com

Formac is a pharmaceutical R&D company engaged in drug delivery and development.
www.formacpharma.com

InsPyro improves and develops new sustainable high-temperature metallurgical processes.
www.inspyro.be

LayerWise, now part of 3D Systems, is active in metal rapid additive manufacturing.
www.3dsystems.com

METALogic is an integrated service provider in the field of corrosion.
www.metalogic.be

Figures

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(figures October 2017)