General overview in advanced ceramics in the FP7

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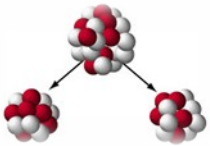
Seventh Framework Progamme

FP7 subprogrammes and ACM

7th Research Framework Programme, FP7

Cooperation 32365m€	Ideas (ERC) 7460m€	People 4728m€	Capacities 4217m€	Euratom 2751m€	JRC 1751m€
					
					

Projects in Advanced Ceramic Materials

62 projects 194 599 366€	11 projects 21 182 638€	31 projects 21 301 524€	17 projects 18 725 358€	1 project 5 450 000€	0 projects 0€

Number of FP7 Projects in

Cooperation	Ideas (ERC)	People	Capacities	Euratom	JRC
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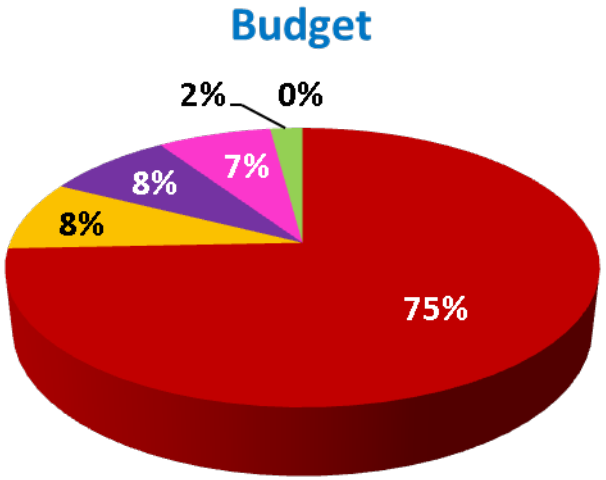
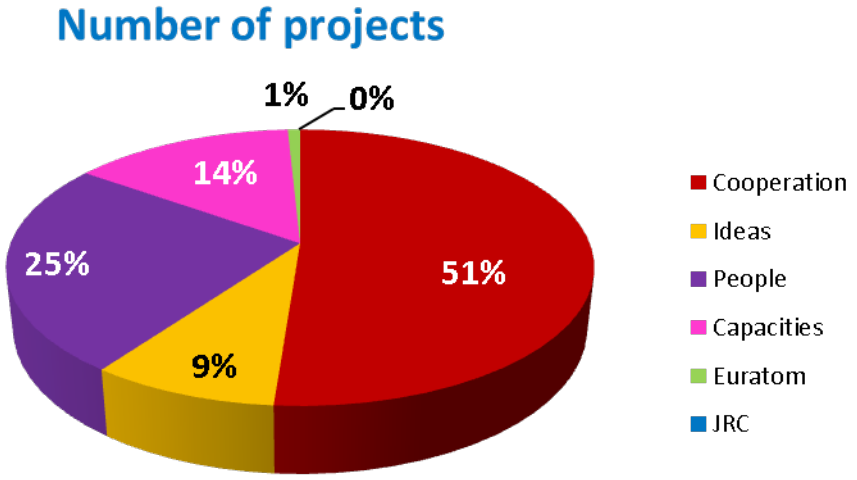
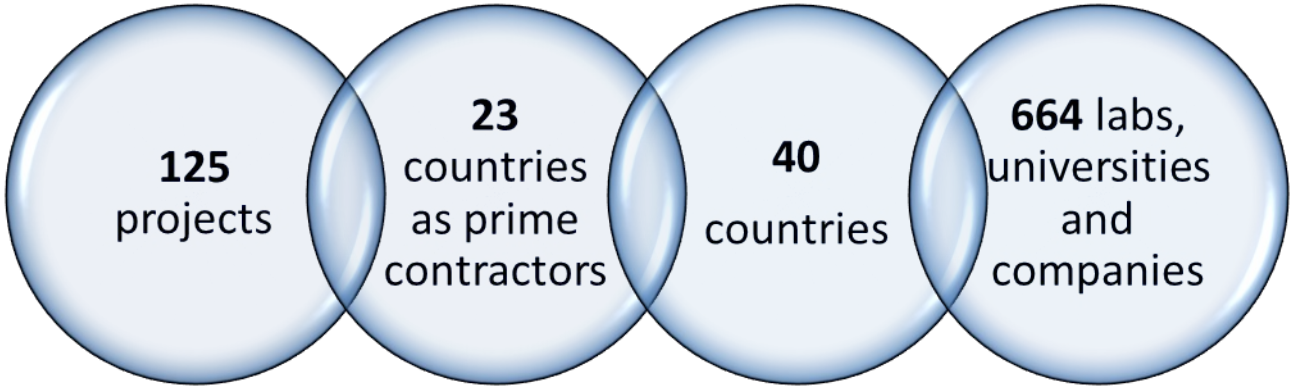




FP7 Projects in Advanced

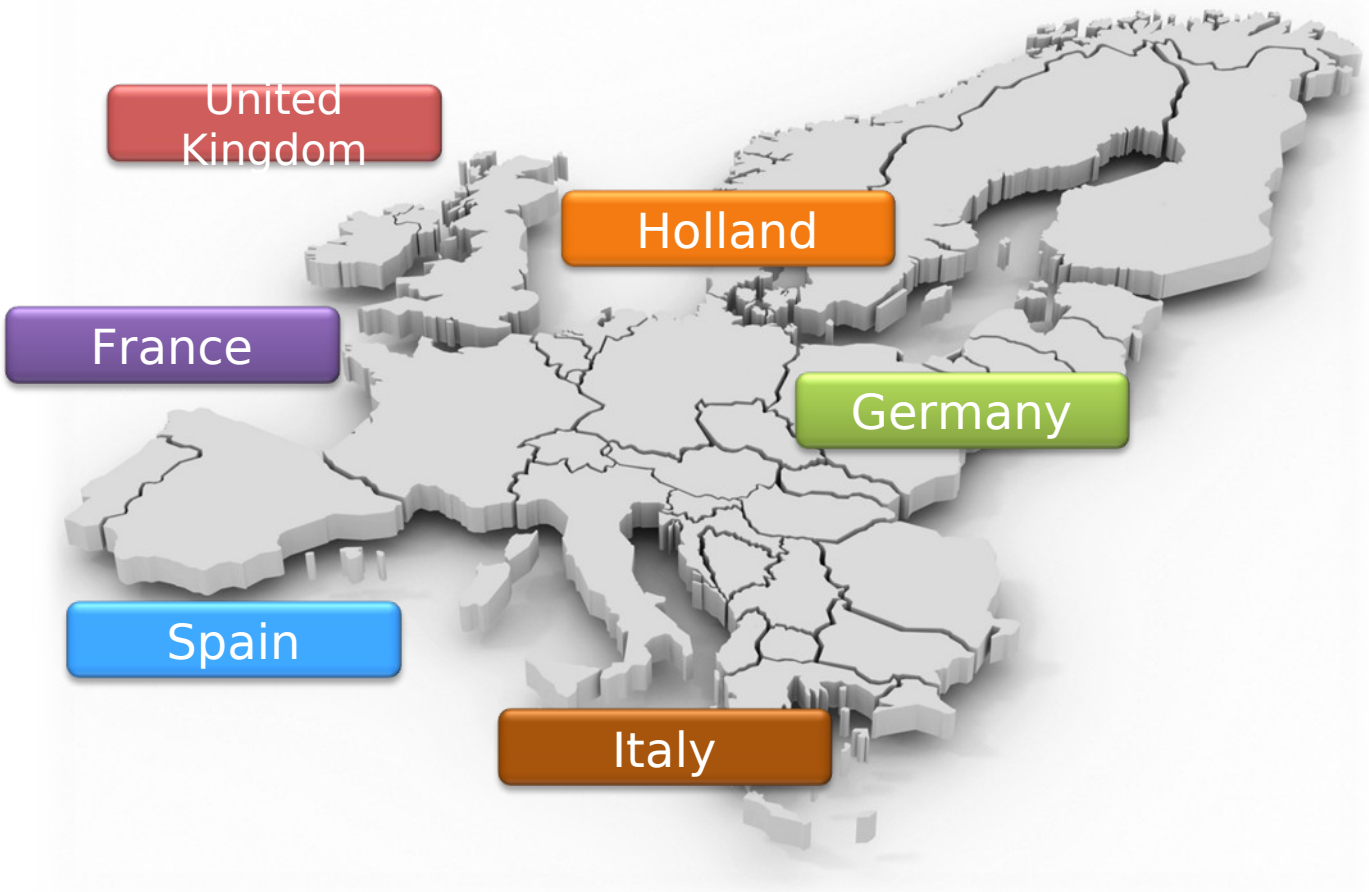


Belgium
Bulgaria
Chyprus
Czech Republic
Denmark
Eire
France
Germany
Greece
Hungary
Italy
Lithuania
Luxembourg
Malta
Netherlands
Österreich
Poland
Portugal
Romania
Serbia
Slovenia
Spain
Sweden
Swizerland
UK

Argentina
Brazil
Chile
Uruguay

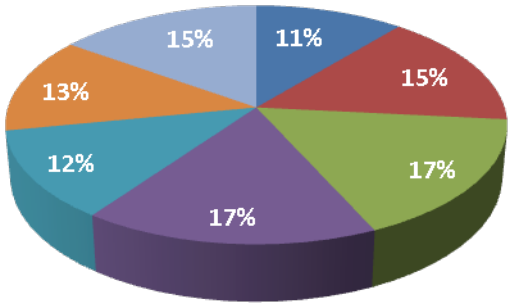
Australia
Canada
China
Egypt
Island
Israel
Japan
Nigeria
Russia
Tanzania
Turkey
Mexico

Advanced ceramic

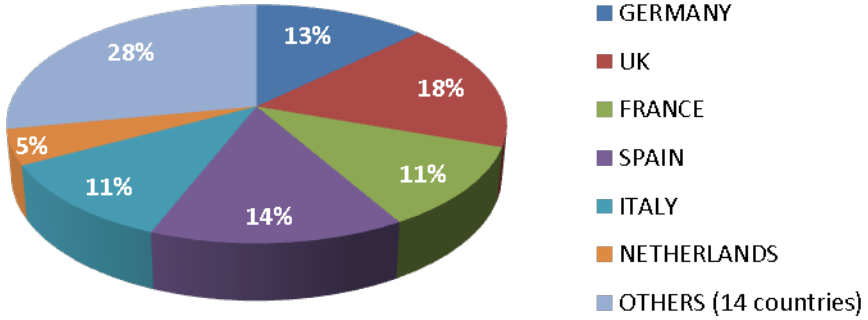


Number of FP7 Projects in

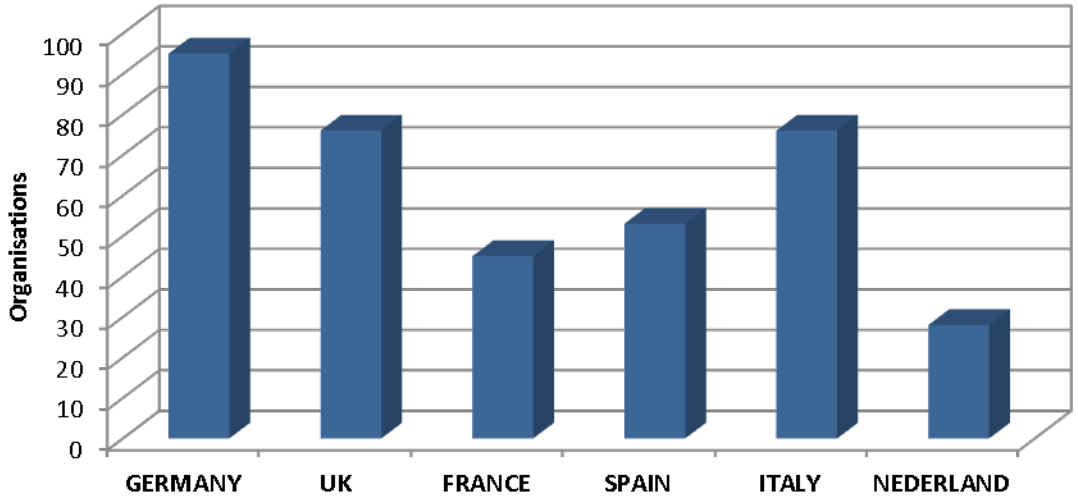
Prime Contractor Country Budget



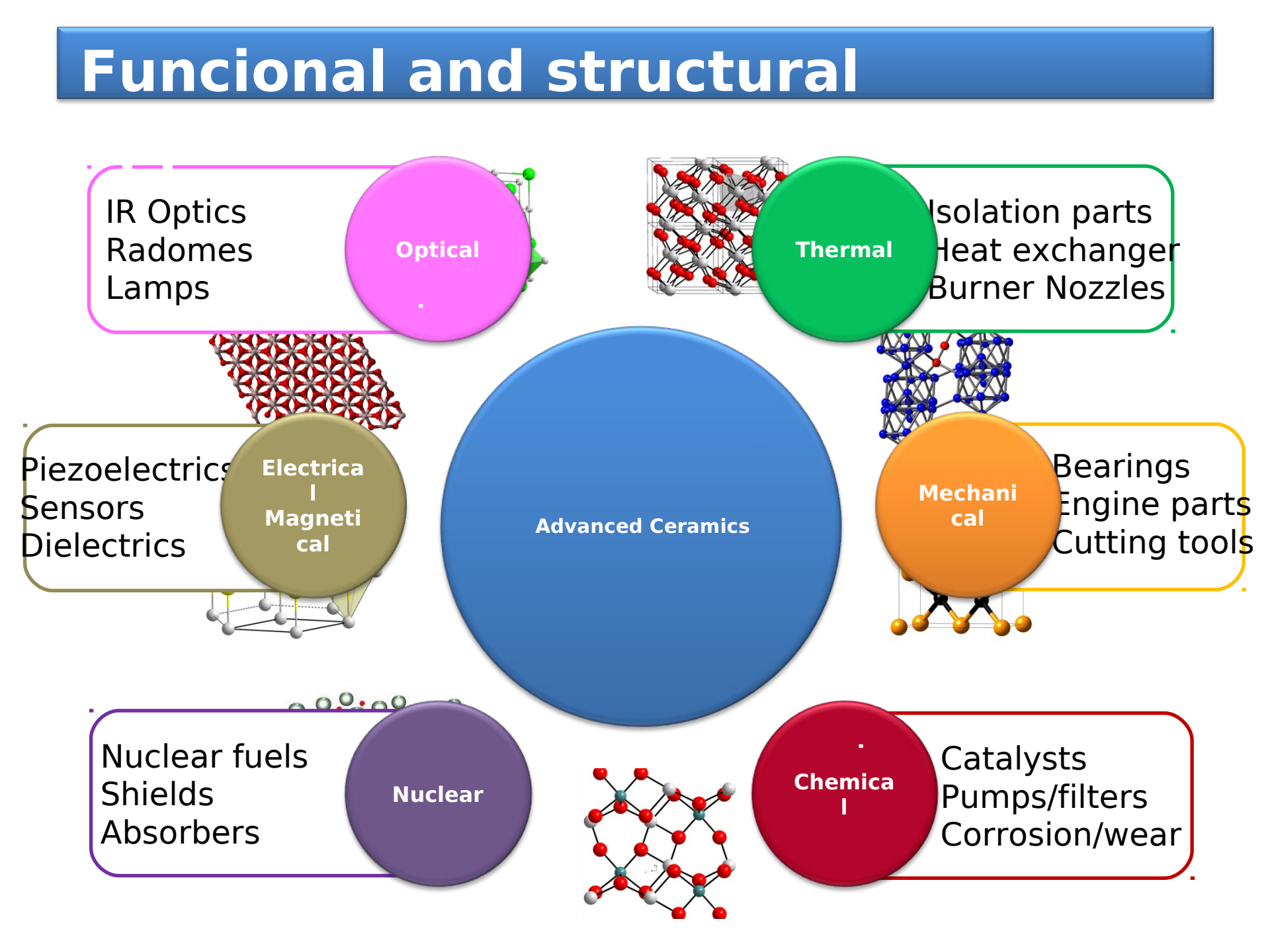
Prime Contractor Country Project Amount



Number of participating organisations



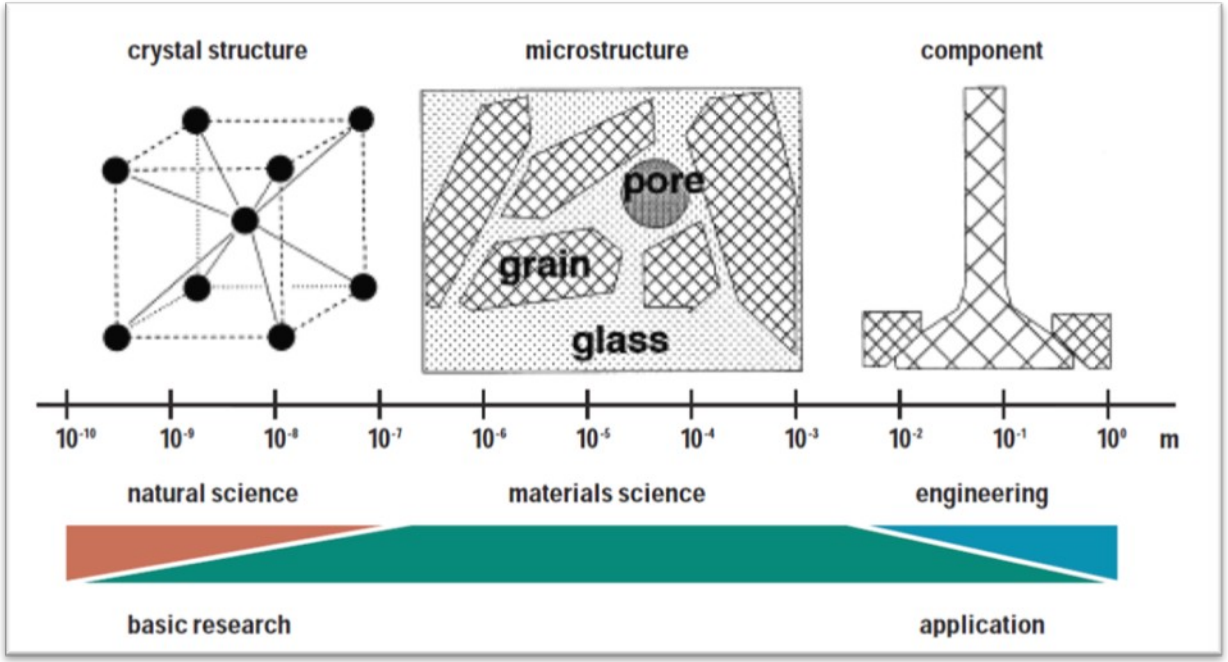
Funcional and structural



Trends in Technology

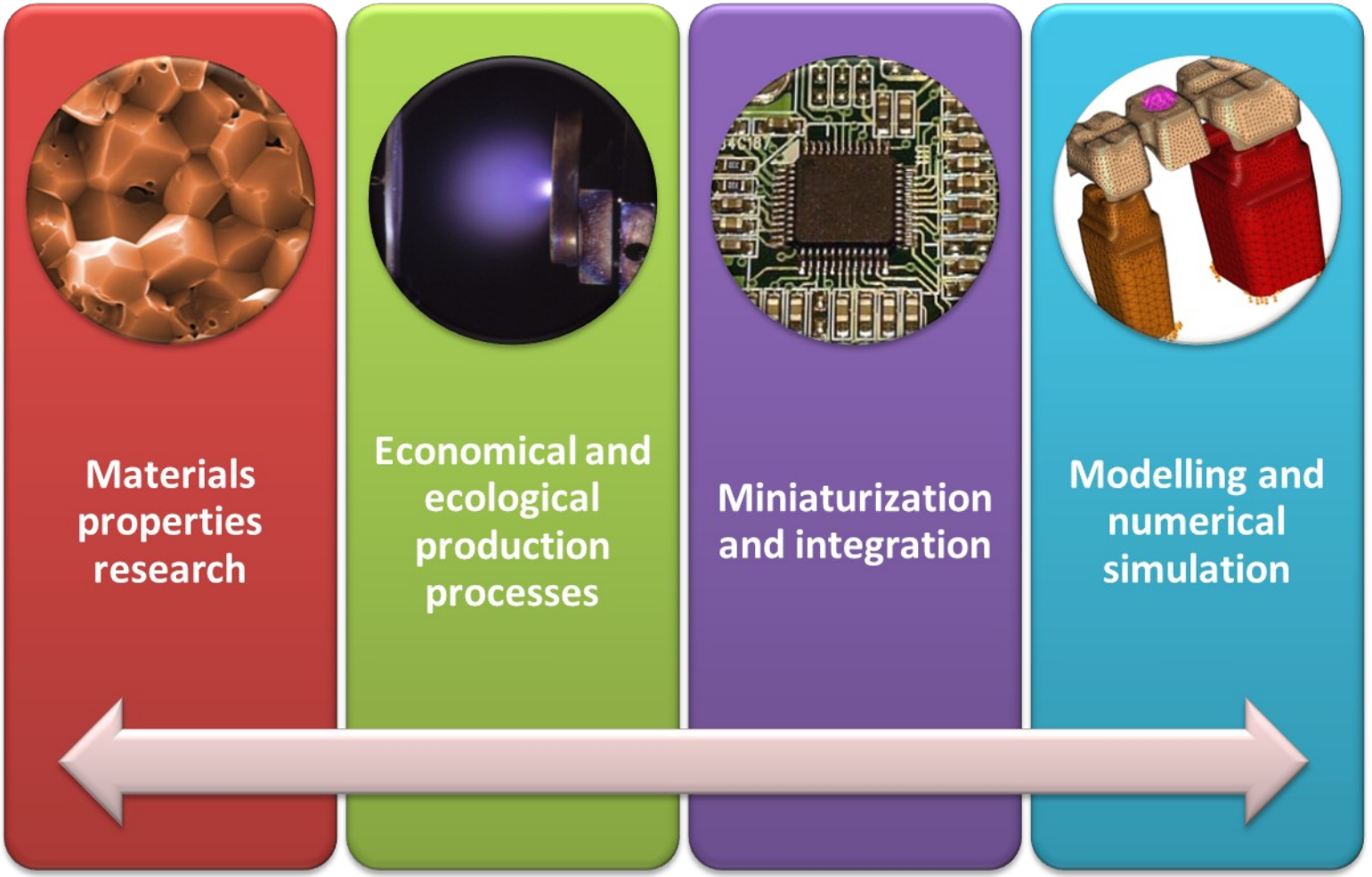
Production and engineering of materials and components

Materials knowledge



Gaps in the basic understanding of materials!!

4 Trends in Technology



Trend 1: Materials properties

Ferroelectric
- High dielectric permittivity
- High piezoelectric constants

Piezoelectric
- Broad-range of applications
- Interdisciplinarity

Magnetoresistive
- Change in their electrical resistivity

Ion Conduction
- High dielectric permittivity
- High piezoelectric constants

Superconductors
- Broad-range of applications
- Interdisciplinarity

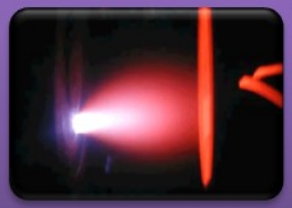
Superhard
- Change in their electrical resistivity

MAX-phase
- High dielectric permittivity
- High piezoelectric constants

Low-thermal expansion
- Broad-range of applications
- Interdisciplinarity

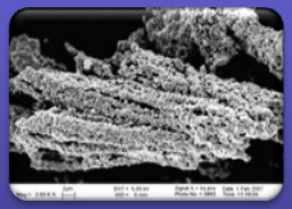
Highly thermal conductive
- Change in their electrical resistivity

Trend 2: Processing and



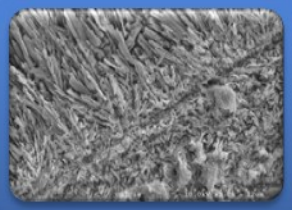
Deposition techniques

- PVD, PLD, CDS, CVD
- Microscopic scale without powder processing



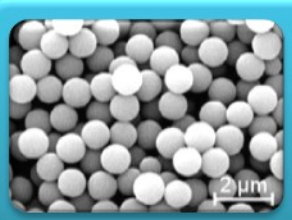
Solid State Thermolysis (SST)

- Thermally induced transformation of preceramic compounds
- Many parameters under control



Inspiration by Biomineralization

- Biomimetic techniques
- At ambient conditions



Conventional elaboration processes

- Surface chemistry of powders
- Interaction between particles during colloidal powder processing

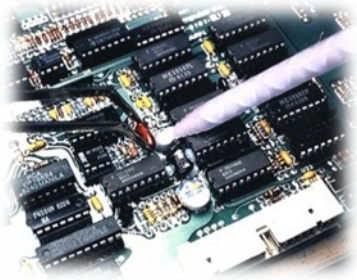
Trend 3: Miniaturization and

Miniaturization

Nanosized effects and nanotechnologies

Ultrathin films, multilayers, interface controlled materials, nanocomposites, metastable systems with high information content on the nanoscale

Integration



Function - integration

Classical fracture mechanics not appropriate

Design validation → testing methodologies

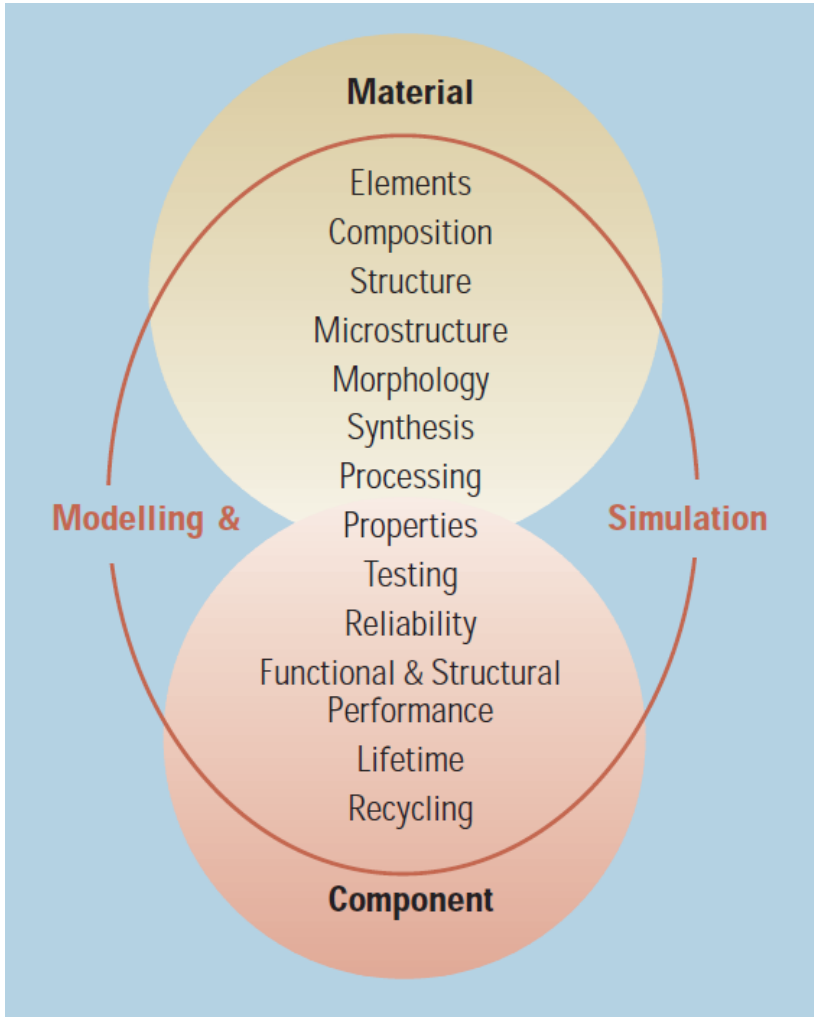
Trend 4: Modelling and numerical

Fundamental theories

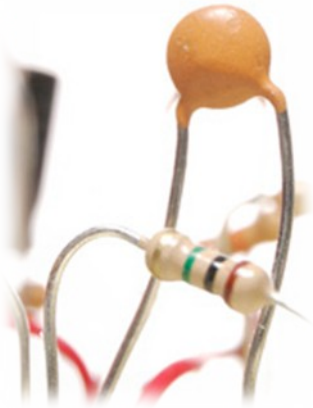
Elasticity
Plasticity
Fracture
Thermodynamics
Electricity
Magnetism

Chemical concepts

Behaviour of materials and compounds

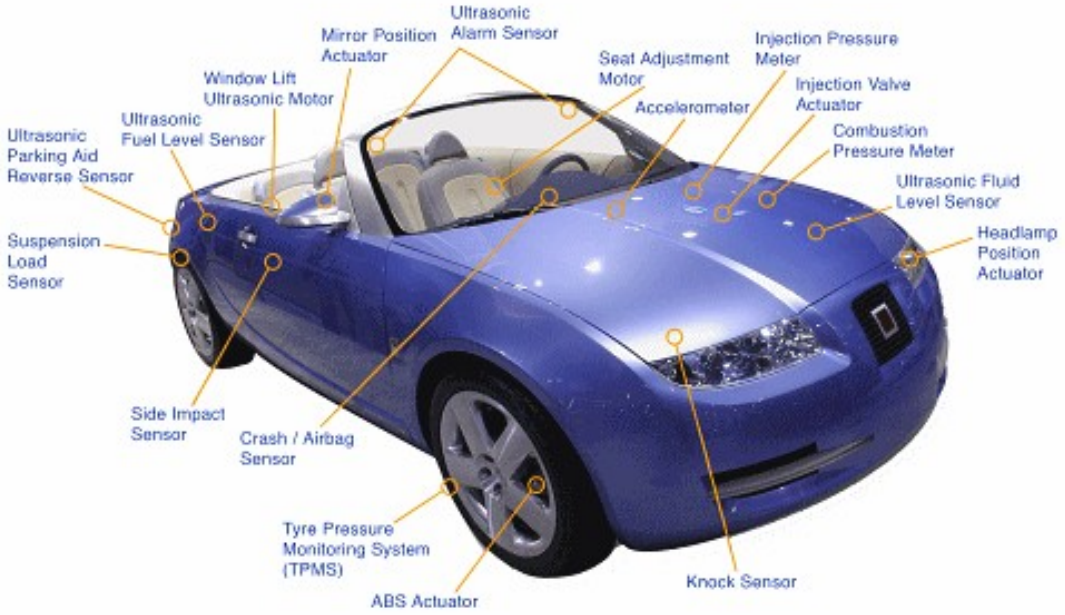


ACM application fields



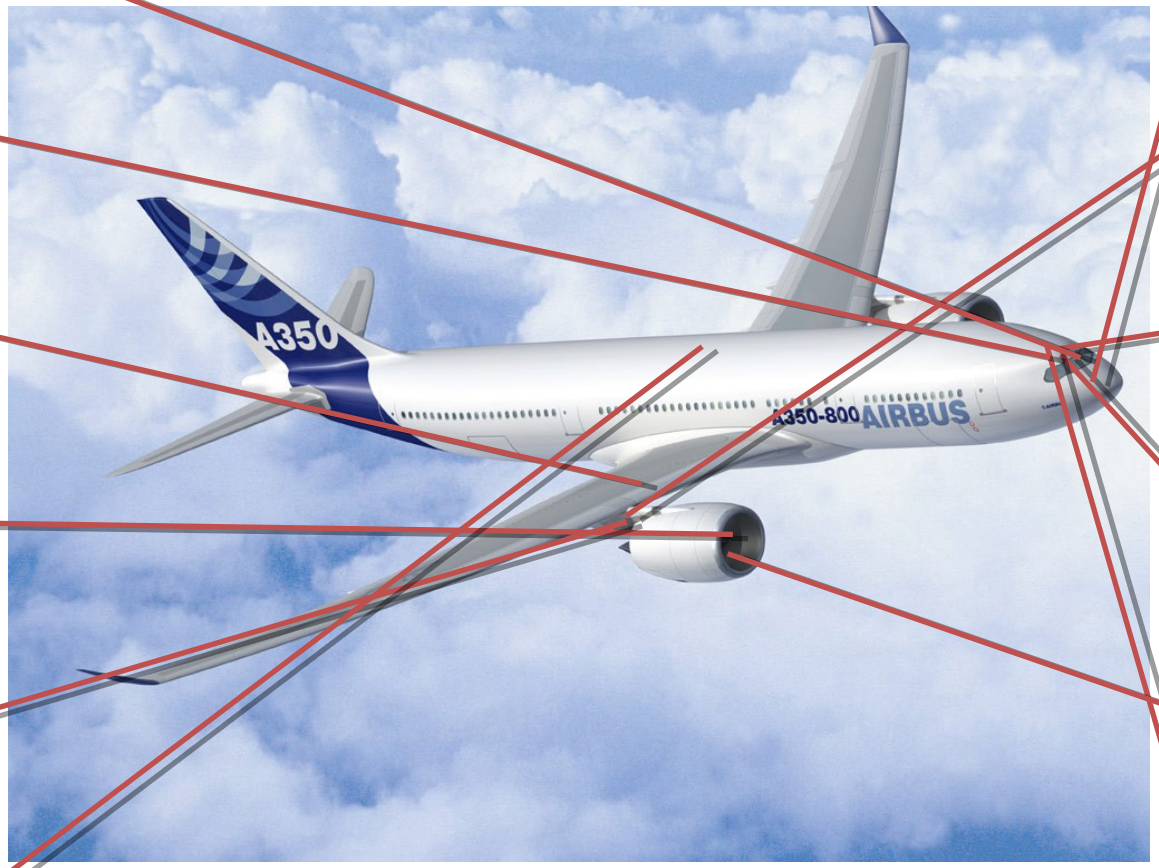
ACM Automotive applications

- Alumina
- Aluminum Nitride
- Braze Alloys
- DLC Coating
- Glass preforms
- Piezo Ceramics
- Silicon carbide
- Silicon Nitride



ACM Aerospace applications

Braze materials



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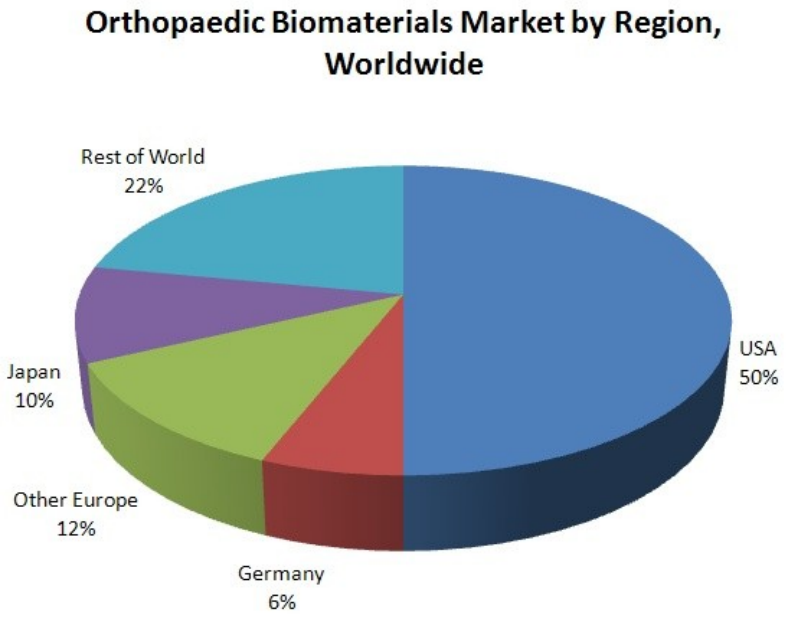
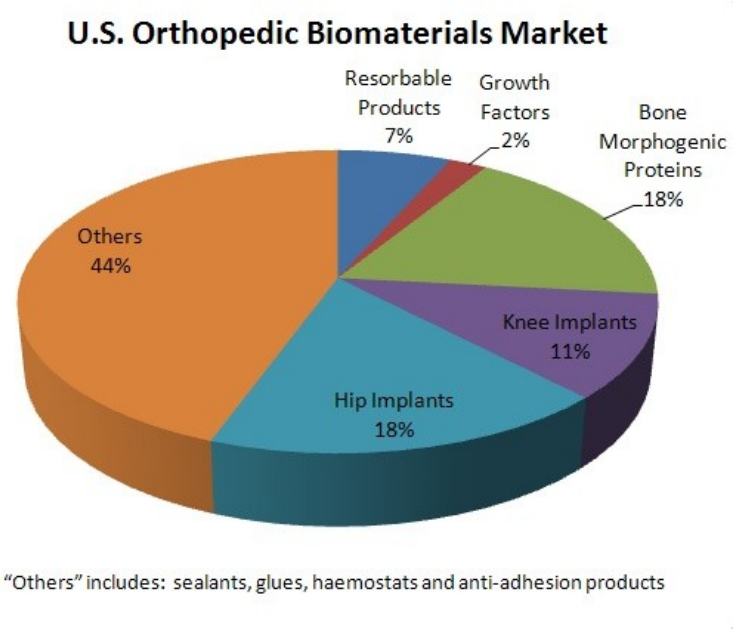
ACM in Health and Medicine



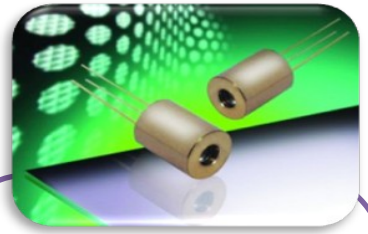


Applications

- Prostheses
- Surgical instr.
- Blood separation
- DNA testing
- Bone screws
- Heart pumps
- Medical imaging
- Blood flow
- Bone stimulators
- Cochlear implants
- Air in-line sensors
- X-Ray equipments

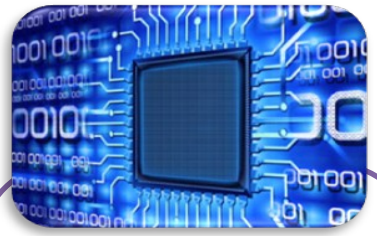
ACM Electronic applications

- Alumina
- Aluminium nitride
- Ceramic/metal
- Dielectrics
- Soft coatings
- Steatite
- Precision Glass
- Piezo ceramics
- Macor
- Glass preforms
- DLC
- Diamonschield®



- Insulators
- High power laser diodes
- Optical coatings
- HV Capacitors
- Power supplies
- Photoconductors
- IR Detectors...

- Chip inductors
- Antennas
- GPS antennas
- Transformers
- Transmitters
- Touch screens
- Fibre optic switches
- Power storage

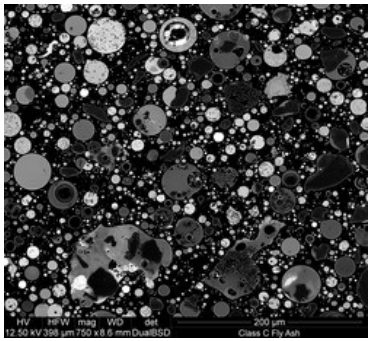


- Bearings
- Transformers
- Anti vibration devices
- Printers
- Profilometers
- Surface testing equipment...

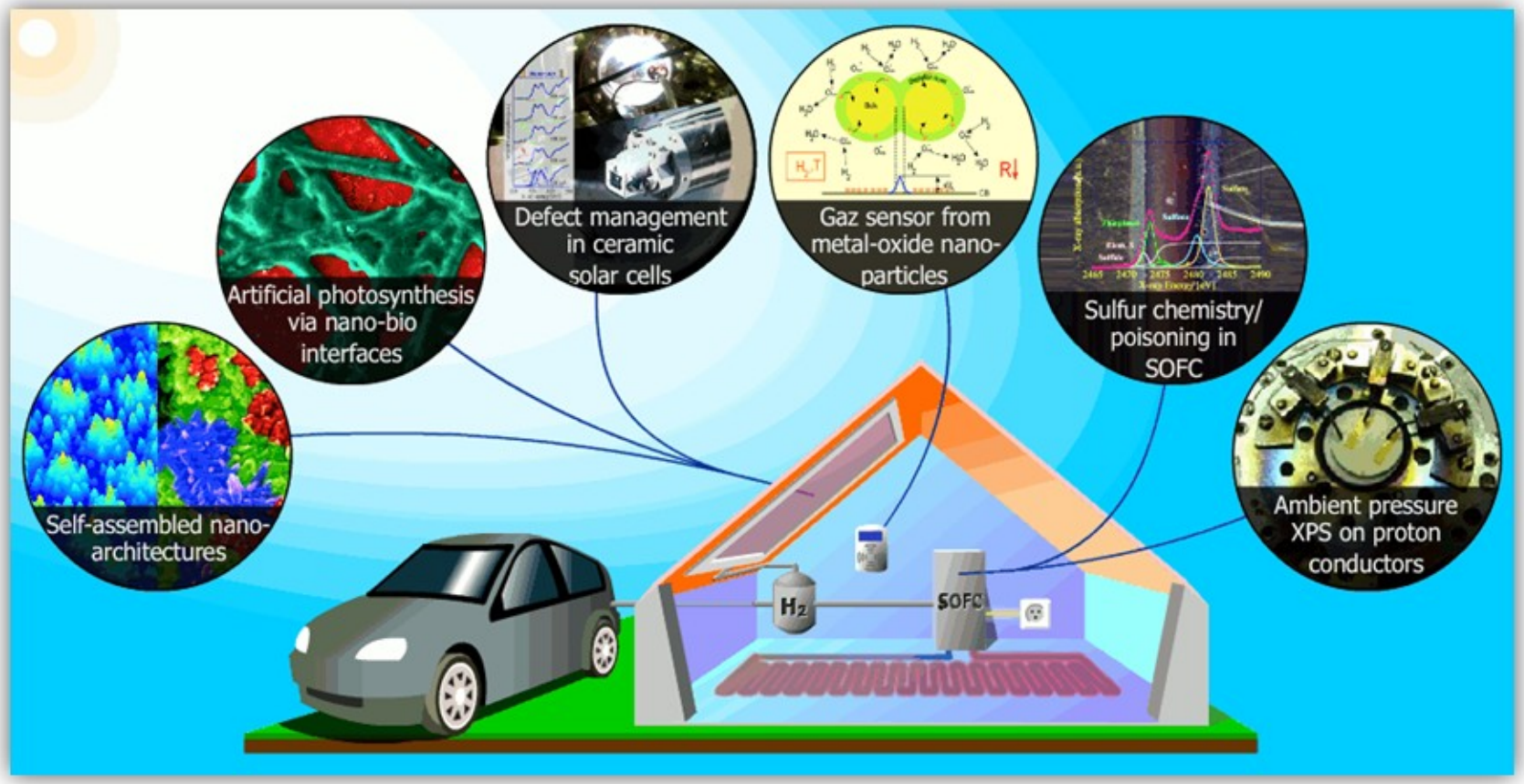
ACM in Environment

Objective: reduction of polltuants

- Particle filters
- SO_x and NO_x decompositi on
- Refractories Flying ashes
- Hyperfiltrati on and nanofiltratio n
- Nuclear waste treatment
- Ceramic recycling
- Antibacterial tiles

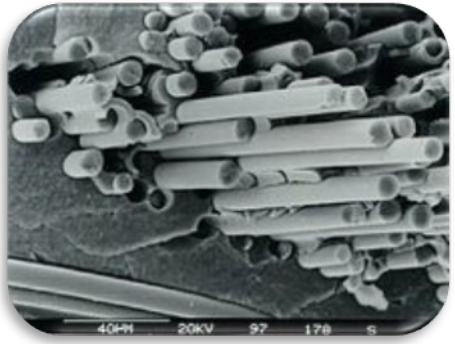


Energy applications



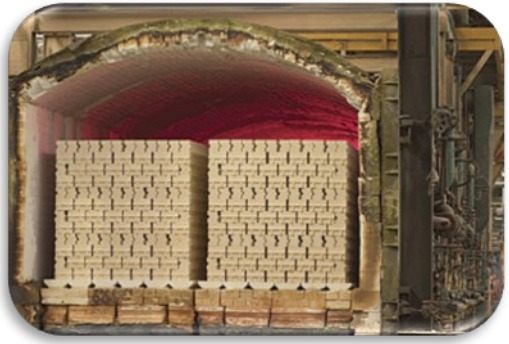
Other applications…

Fibre-reinforced ceramic composites



- Ceramic Matrix Composites
- Reinforcement
- Protection against oxidation
- Reliability

Refractories



- Microstructures modelling
- Refractory properties

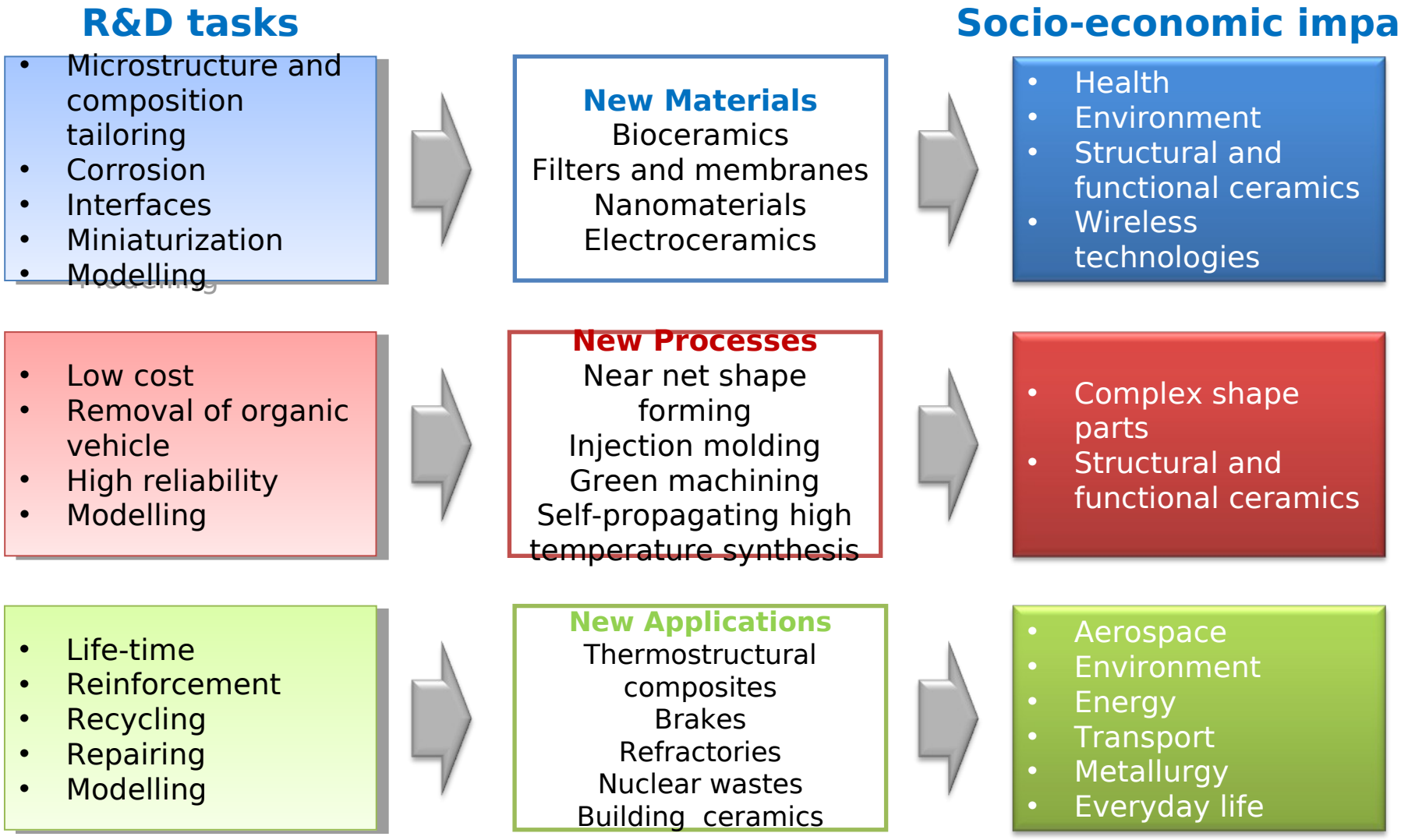
Building materials

- Concrete → water
- Fibre reinforcement
- Temperature
- Fibres, interfaces, corrosion, recycling, new concretes…

Needs in basic research for

- Near net shape forming
- Processing of complex shapes with high reliability
- Hybrid bones
- Catalytic redution
- Membranes
- Nuclear wastes
- Recycling
- Antibacterial actions
- Nanopowders
- Carbon nanotubes
- Nanomaterials and nanocomposites
- Nanostructured sensors
- Sensors
- Electro-optical devices
- Superionic conductors
- Ferroelectrics
- Miniaturization
- Multilayer materials
- Interfaces
- Self healing composites

Socio-economic impact & overview



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THANK YOU!