RWTH, Peter Winandy

Institut für Textiltechnik of RWTH Aachen University

Fibre based solutions for society needs

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RWTH Aachen University

Integrated technical University

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RWTH Facts & Figures

- 42,000 students
  in 115 different course programmes
- 260 institutes
- 8,700 staff (65% scientists)
- 900 mill. € budget
- 350 mill. € external funds

status: 1st August 2015

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Faculties of RWTH Aachen University

- Mathematics, Computer and Natural Sciences
- Architecture
- Civil engineering
- Mechanical engineering
- Mining, Metallurgy, Geosciences
- Electrical engineering, Information technology
- Philosophy
- Economic sciences
- Medicine

ITA has cooperation projects with chairs and institutes from all RWTH faculties.

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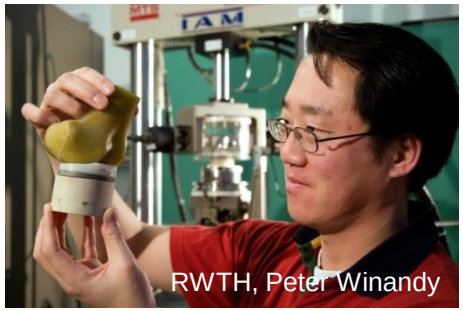
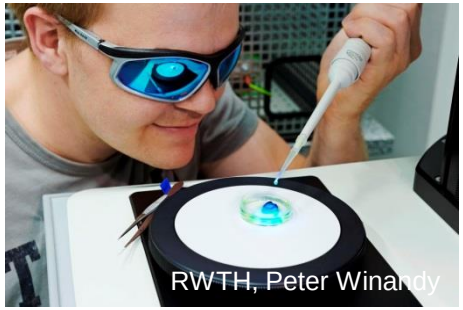
Interdisziplinary research at RWTH

Focus on:

- Production engineering
- Mobility and transport, automotive technology
- Information and communication sciences
- Materials science
- Energy and process engineering
- Medicine and medical engineering
- Computational science

ITA is involved in all of these.





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The ITA-network at the research site Aachen

Joint research with:

- Institutes from all faculties of RWTH
- Associated institutes of RWTH
- Fraunhofer-Institutes in Aachen
- Industrial networks & organisations
- City of Aachen, Chamber of Commerce
- University of applied sciences Aachen

ITA serves as a unique network and contact partner for its clients.

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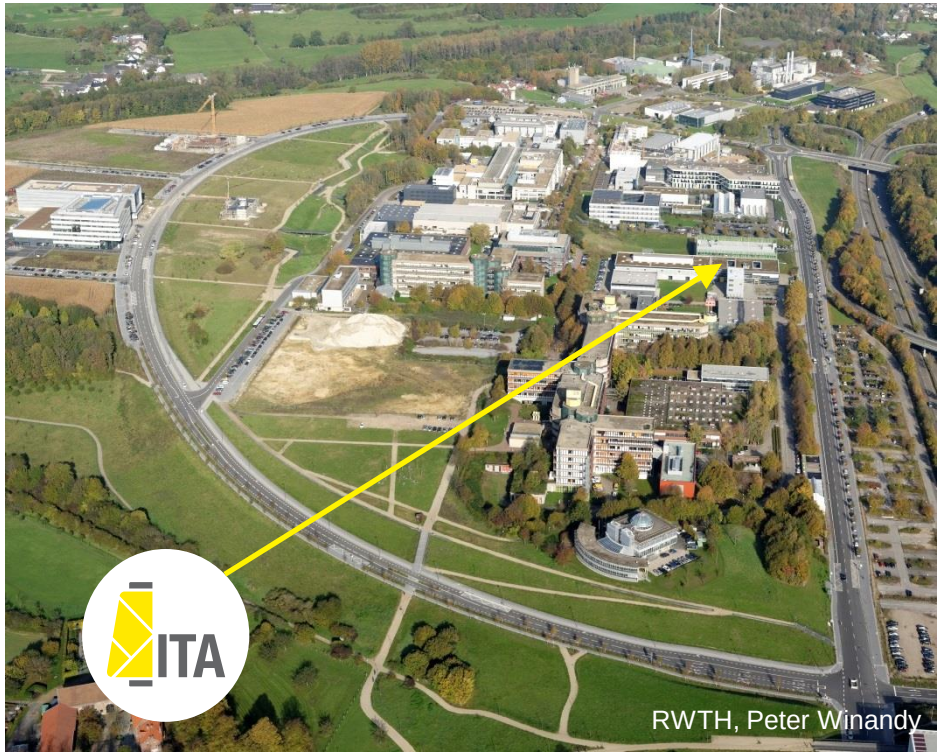
RWTH Aachen Campus

RWTH Campus: a new kind of cooperation between industry and university

- Biggest technology campus in Europe
- Establishment of high-tech companies in 15 different clusters
- Exchange of research results, staff, other resources
- approx. 2 bill. € investments until 2020
- approx. 10,000 jobs in research & development



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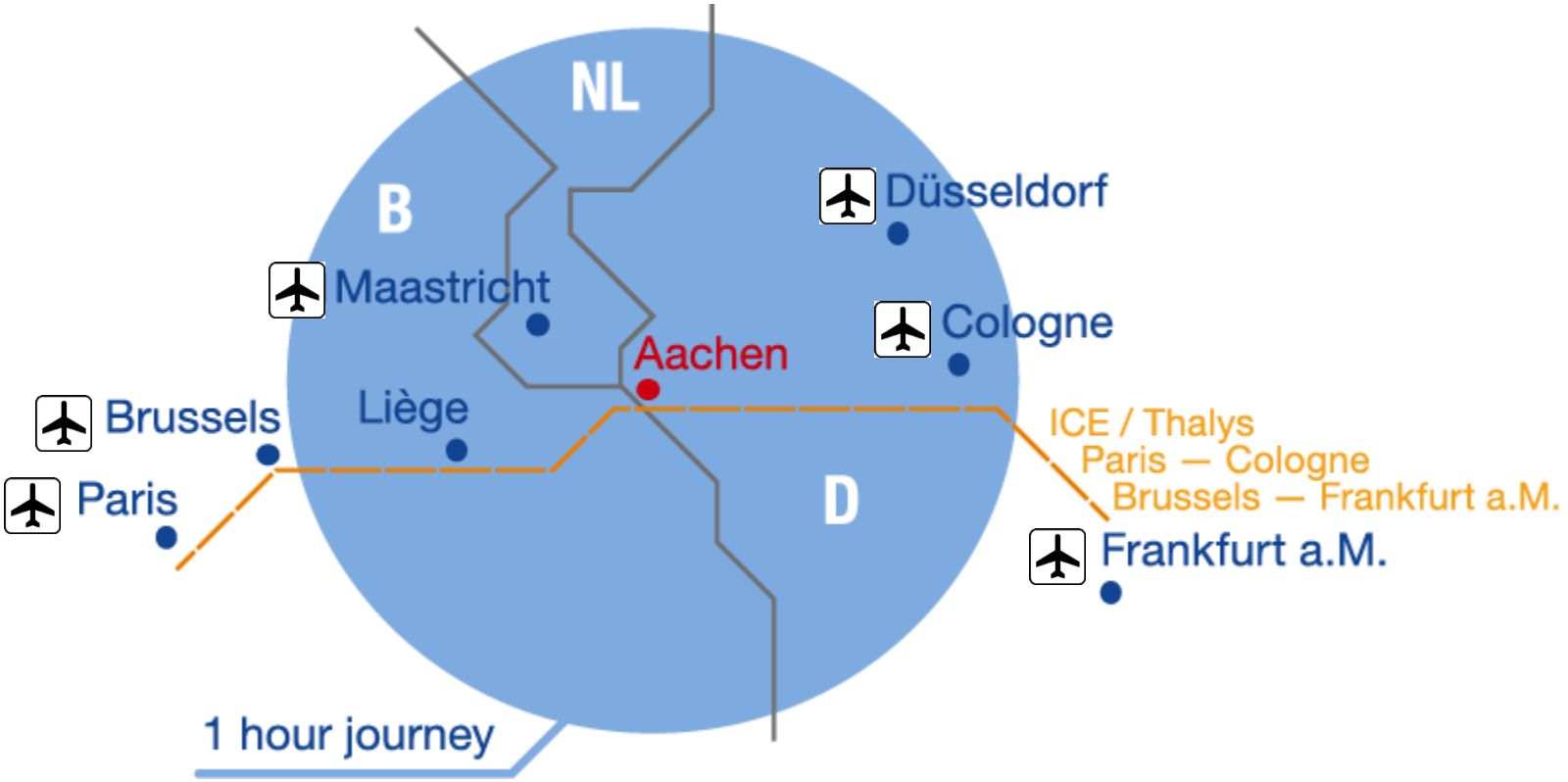
Location in the Euregio: in the centre of Europe



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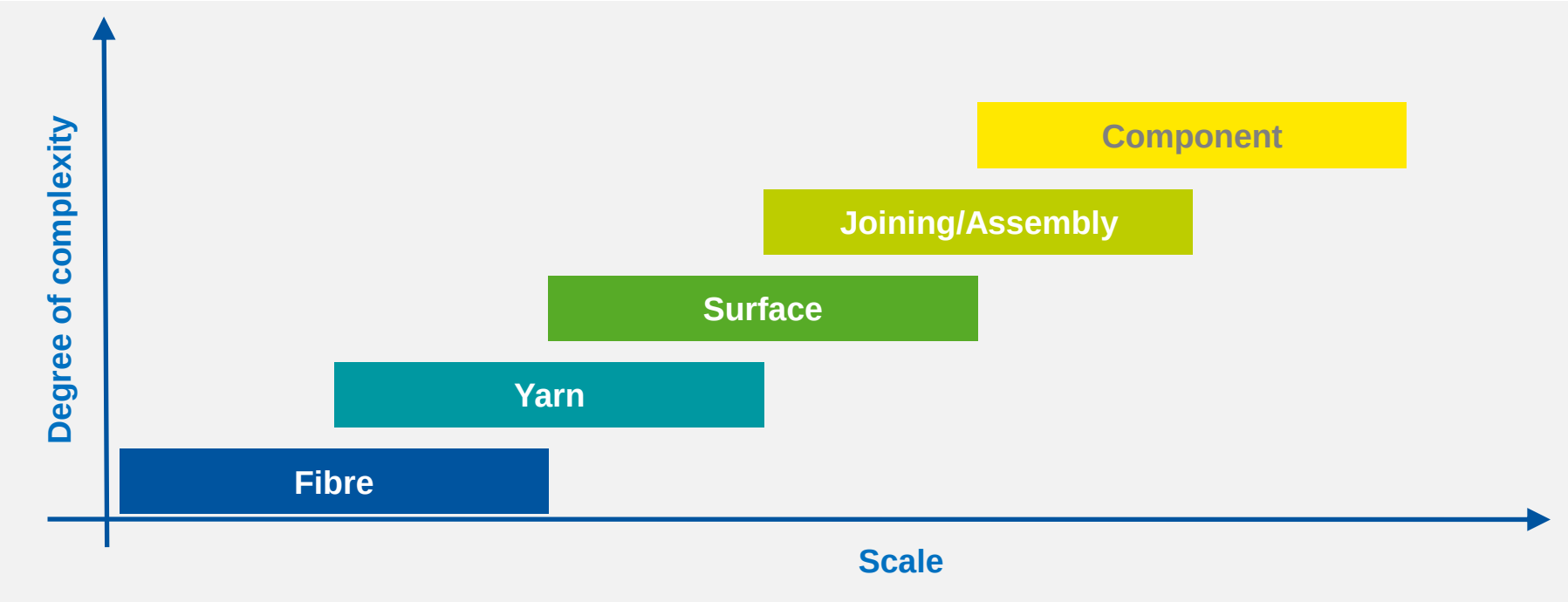
Motivation: fibre based materials

10 %

of all materials are fibre based

Textile structures – from fibre and fabric to component



- Choice of fibre materials & construction of yarn, surface, components
- Adaption of the textile process chain and choice of specifc process parameters

Textiles: „Multiscale“ malleability across all process levels!

Customised materials – customised products

Possible characteristics of fibres & textiles

Characteristic	Parameter
solid & stiff … soft & flexible:	Tensile strength, modul, drape features
light… heavy:	Linear density, specific weight
impermeable … permeable:	Porousity, vapour permeable, hydrophobic
durable … degradable:	mech. abrasion, UV resistence, chemical resistence, degradation
conductor … isolator:	electrical & thermical conductivity

- There is no other material that allows a comparable range of properties.

Textile engineering is the „Enabling Technology“

Positioning of ITA

Provider of research and education

Our strategic approach

INTEGRATED

INTERDISCIPLINARY

INDUSTRY-ORIENTED

INTERNATIONAL

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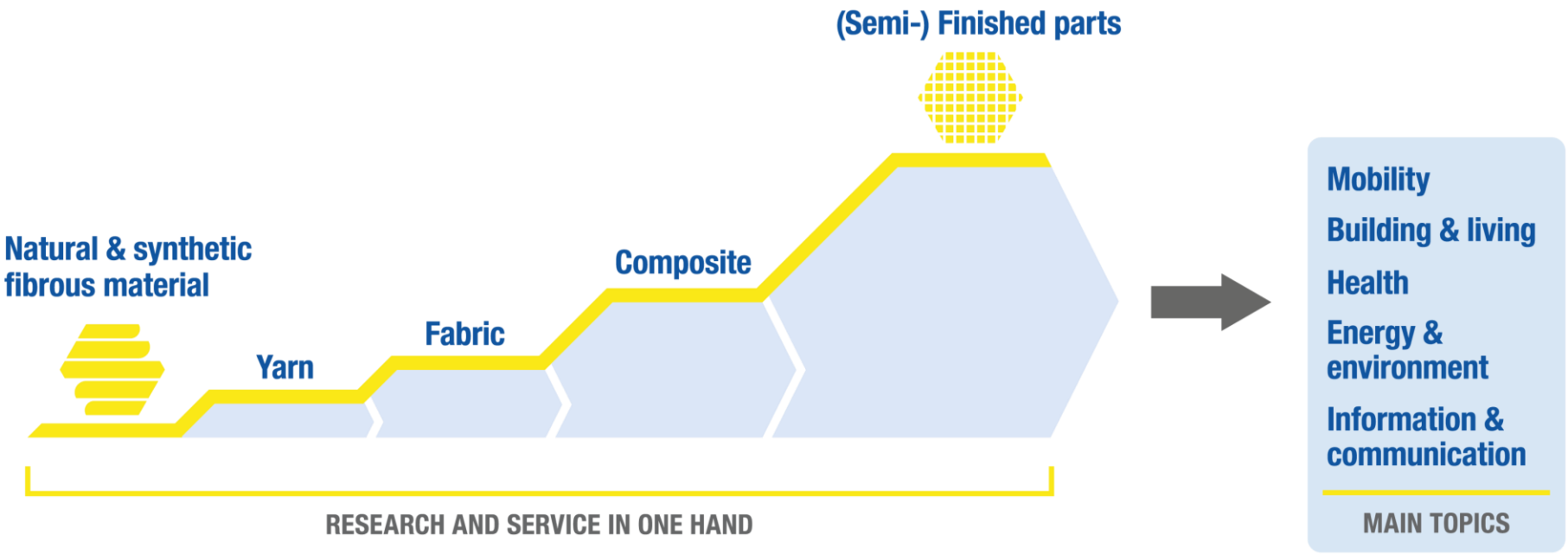
Our approach: Comprehensive service

INTEGRATED INTERDISCIPLINARY



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ITA main topics:

INTEGRATED INTERDISCIPLINARY

Our main topics are our interfaces to:

- Society needs and global mega trends
- Leading themes of the high-tech industry
- Leading themes of the EU- research policy

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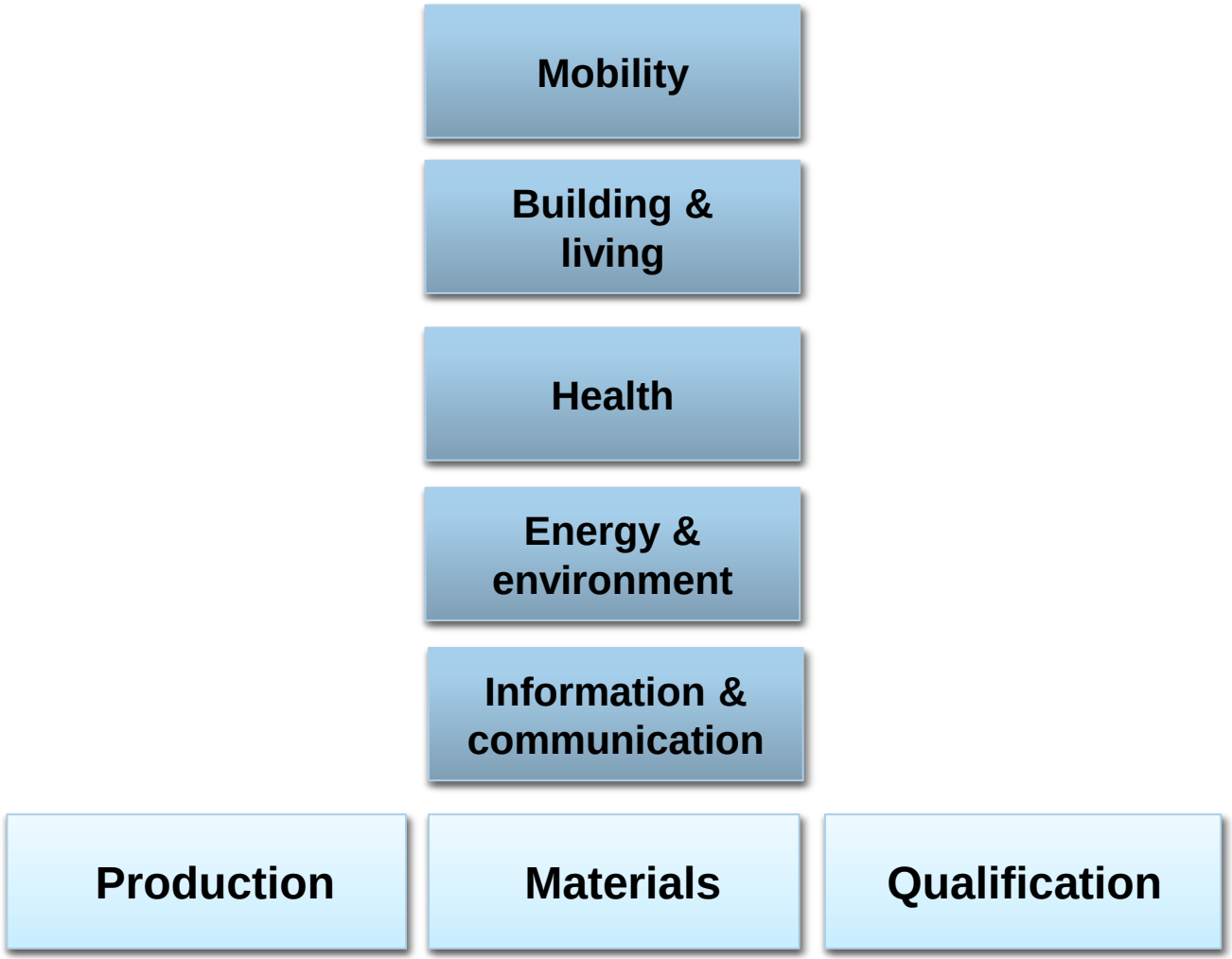
ITA main topics

INTEGRATED INTERDISCIPLINARY



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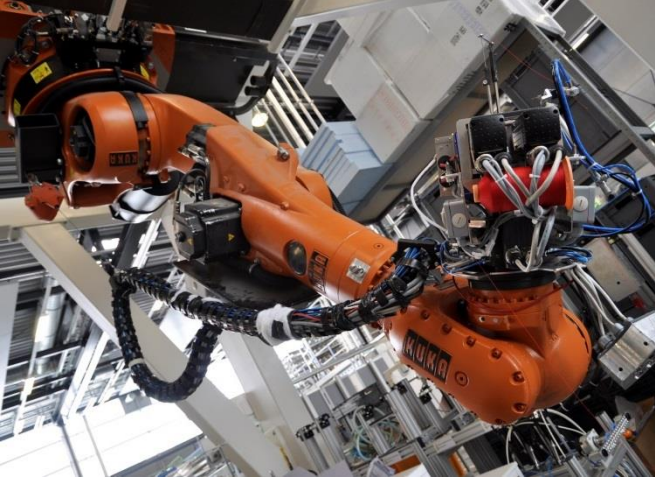
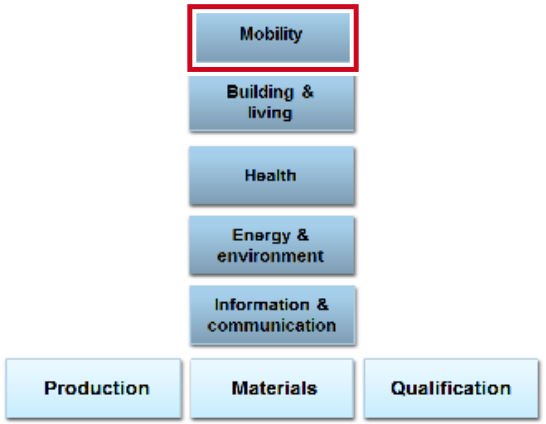



Mobility

- Structural applications, Interior, Transmission, Safety
- Lightweight design
- Automated production
- Tailored reinforcement structures



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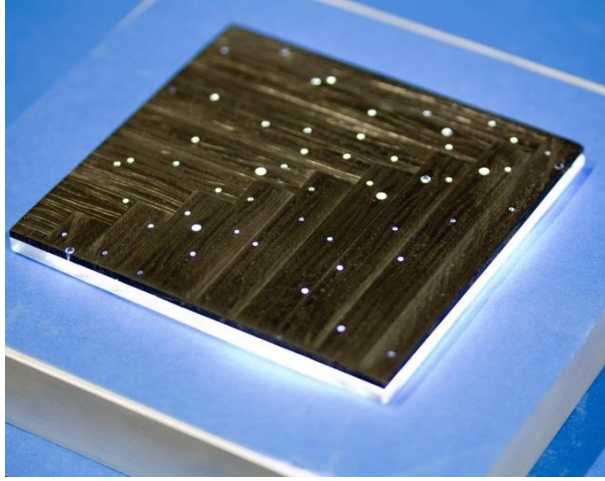
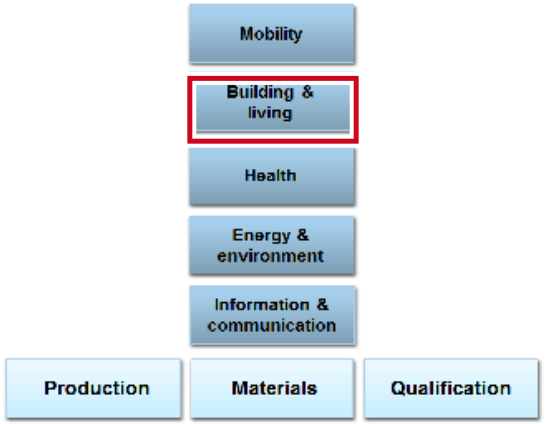


Building and Living

- Textile reinforced concrete
- Translucent concrete
- Integration of functions
- Interior and exterior design
- Geotextiles



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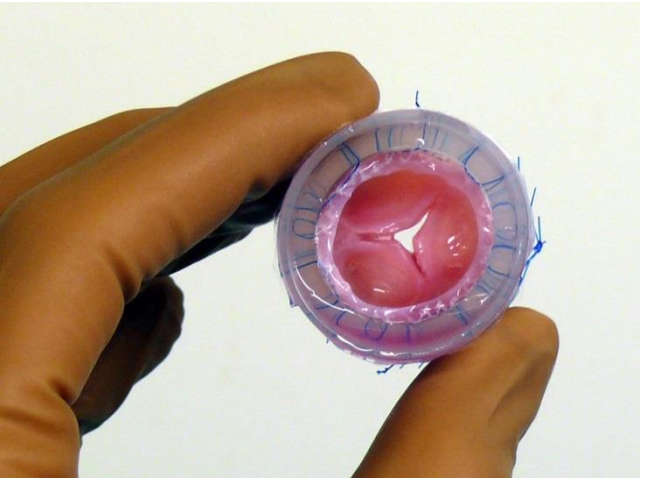
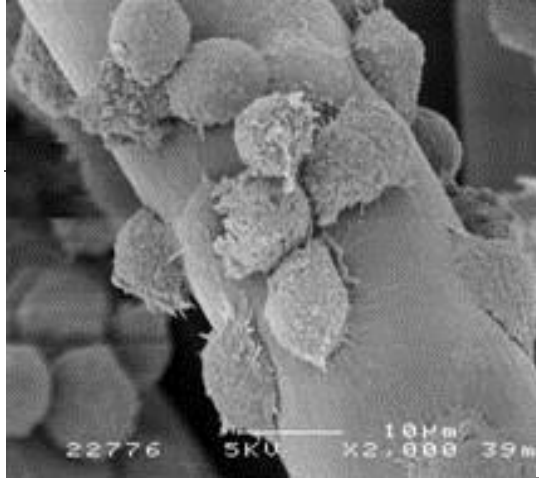
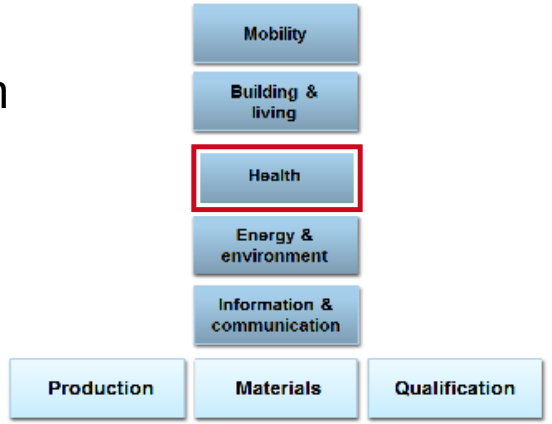
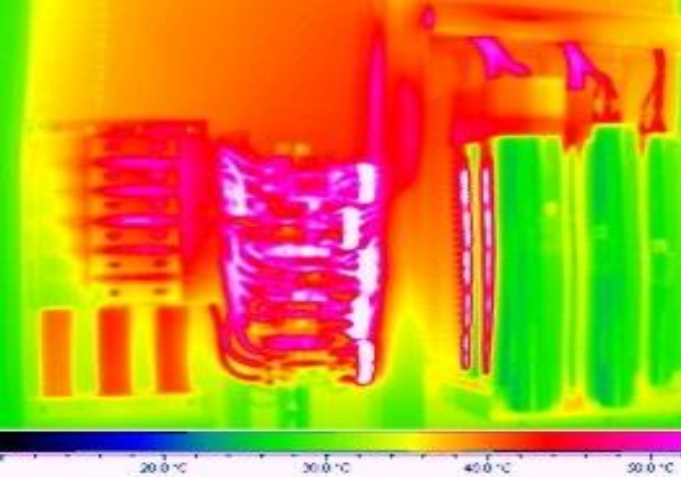


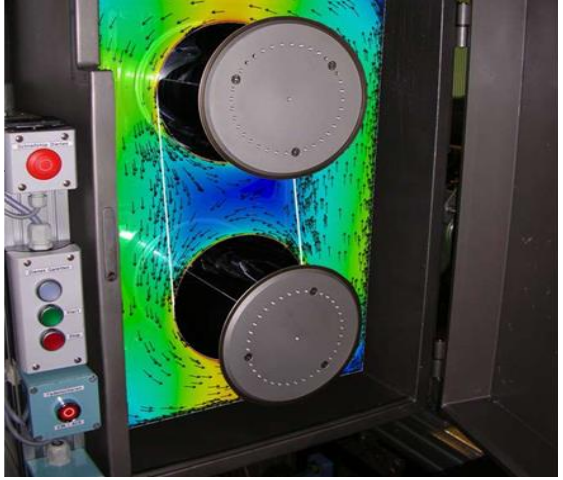
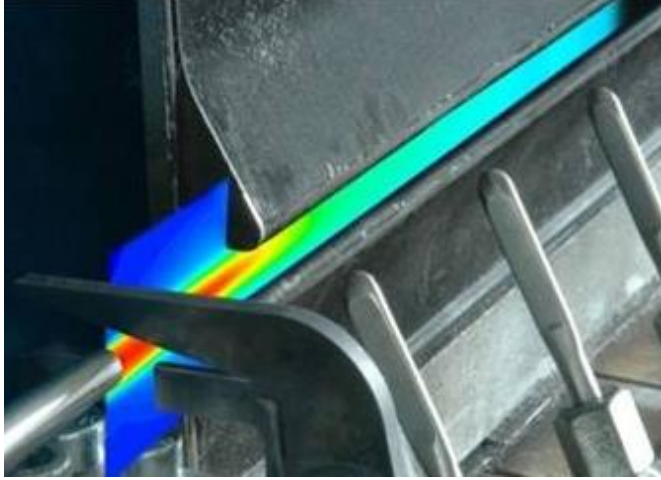


Health

- Textile Implants
- Tissue Engineering and biofunctionalisation of implants
- Medical Smart Textiles: Wearable Electronics for Health
- Wound treatment
- Hospital textiles and hygiene products

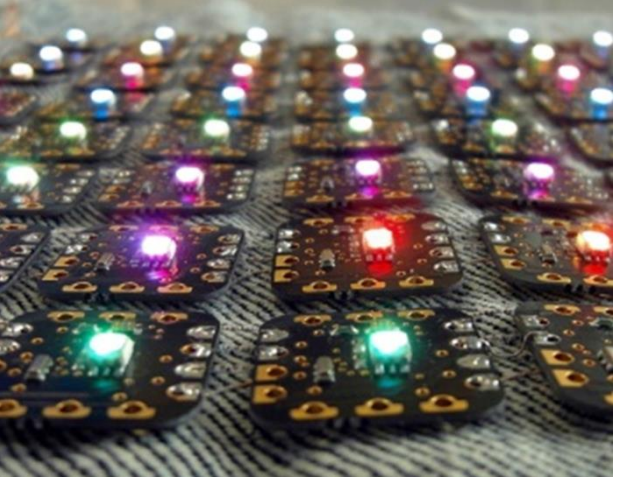


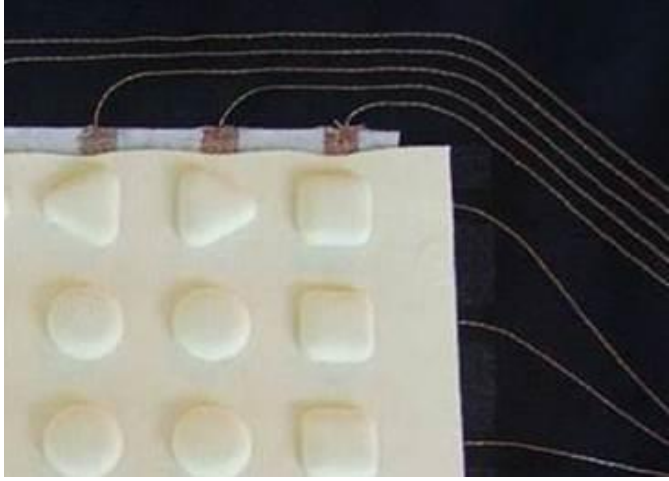


Energy and Environment

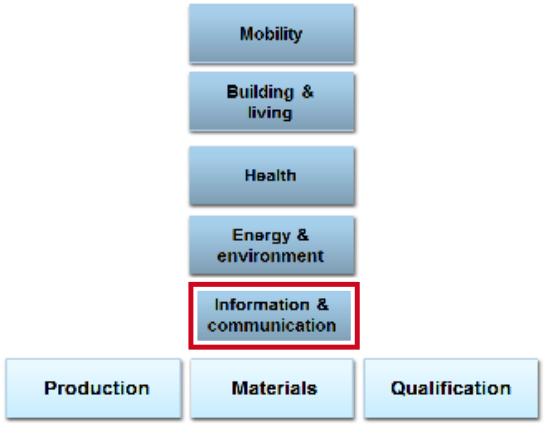
- Energy conversion
- Resource efficiency
- Renewable energy sources
- Recycling
- Biologically based materials

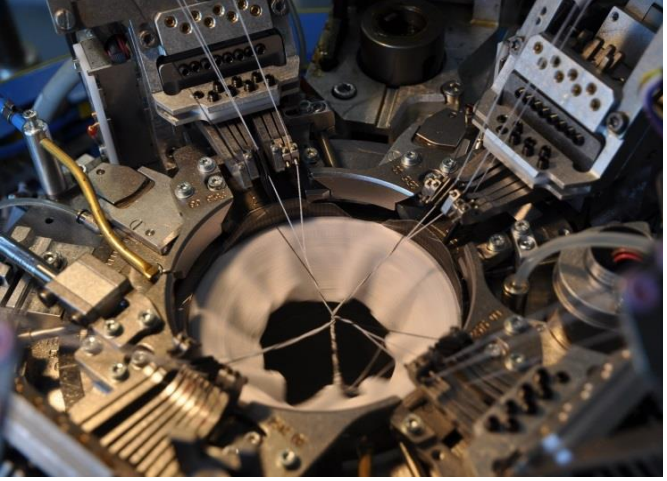


Information and Communication

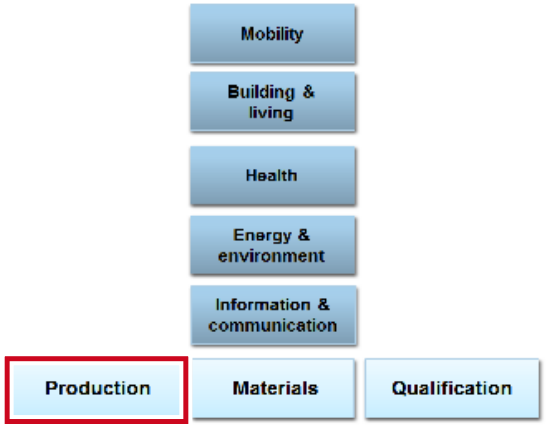
- Signal and information transfer
- Sensors and actuators
- Wearables, Health monitoring
- Ambient assisted living
- Energy harvesting





Production

- Mechanical engineering
- Process and product development
- Quality management/metrology
- Self optimising machines
- Human-Machine-Interface
- Industry 4.0



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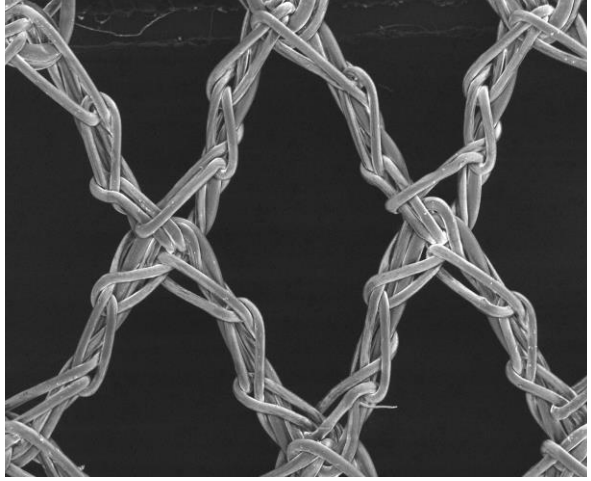
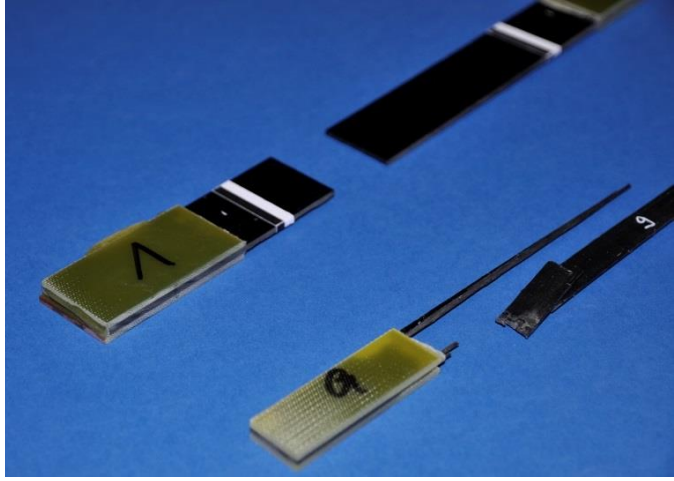
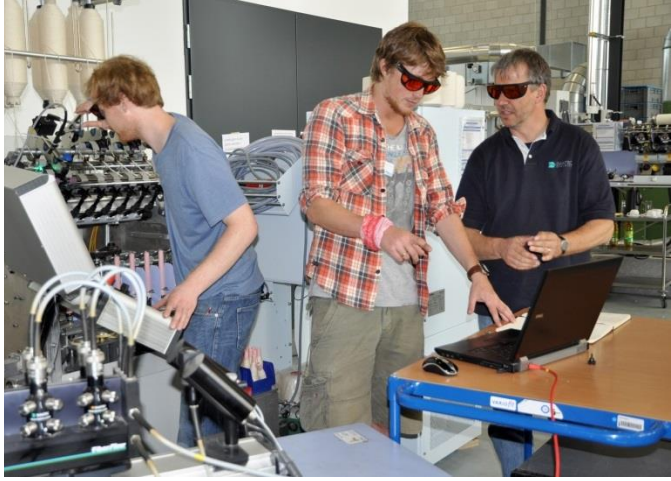



Materials

- Material adaptation and functionalisation
- Customised process and product characteristics
- Multiscale: Molecular → Macroscopic, fibre → component
- Analytics



Qualification

- Academic teaching and industrial training
- Industrial training
- Know-how-transfer
- Professional competence development
- User-friendly technology design

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ITA-Network

Research and education:
ITA as an institute of RWTH

- Professorship „Textile Engineering“
- Professorship „Tissue Engineering“

- Conveying knowledge and building competencies
- Generating innovations
- Developing the strengths of employees

- Third party funded research (public)
- Academic qualification and vocational training
- Advanced training

Technology transfer

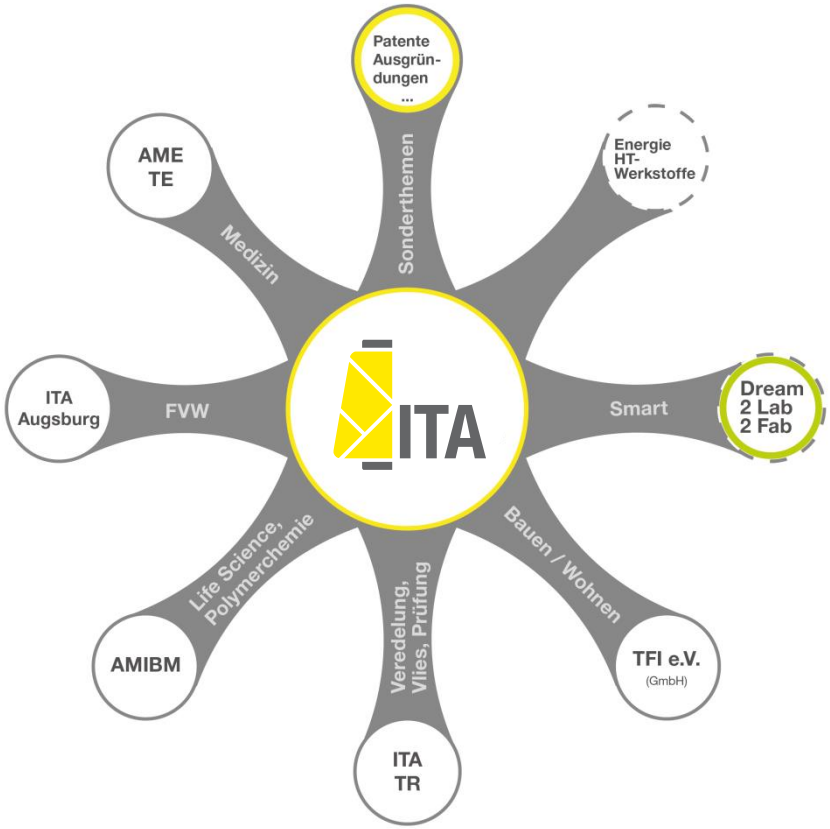
ITA Technology transfer GmbH within the ITA-Group

- ITA GmbH is the contractual partner of the industry for R&D – in the textile engineering sector, textile industry sector and in the technology transfer sector for other branches.
- Sales and contractual aspects of industry projects of the ITA-Network.

The ITA-Group

INTEGRATED INTERDISCIPLINARY

Key partners and spin-offs



- **AME-TE:** Professorship Tissue-Engineering at RWTH
- **ITA Augsburg:** gGmbH at University Augsburg
- **AMIBM:** Aachen-Maastrich-Institute for Biobased Materials;Uni Maastricht (NL)
- **ITA-TR:** Subsidiaries in Turkey (e.g. ITA Bursa)
- **TFI:** Institut für Bodensysteme an der RWTH Aachen e.V.
- **Dream2Lab2Fab:** Cooperation with South Korea for a joined Institute „Smart Textiles“

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Global network – for the products of tomorrow

INTERNATIONAL

Globally operating with focus on certain regions

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ITA – Facts & Figures

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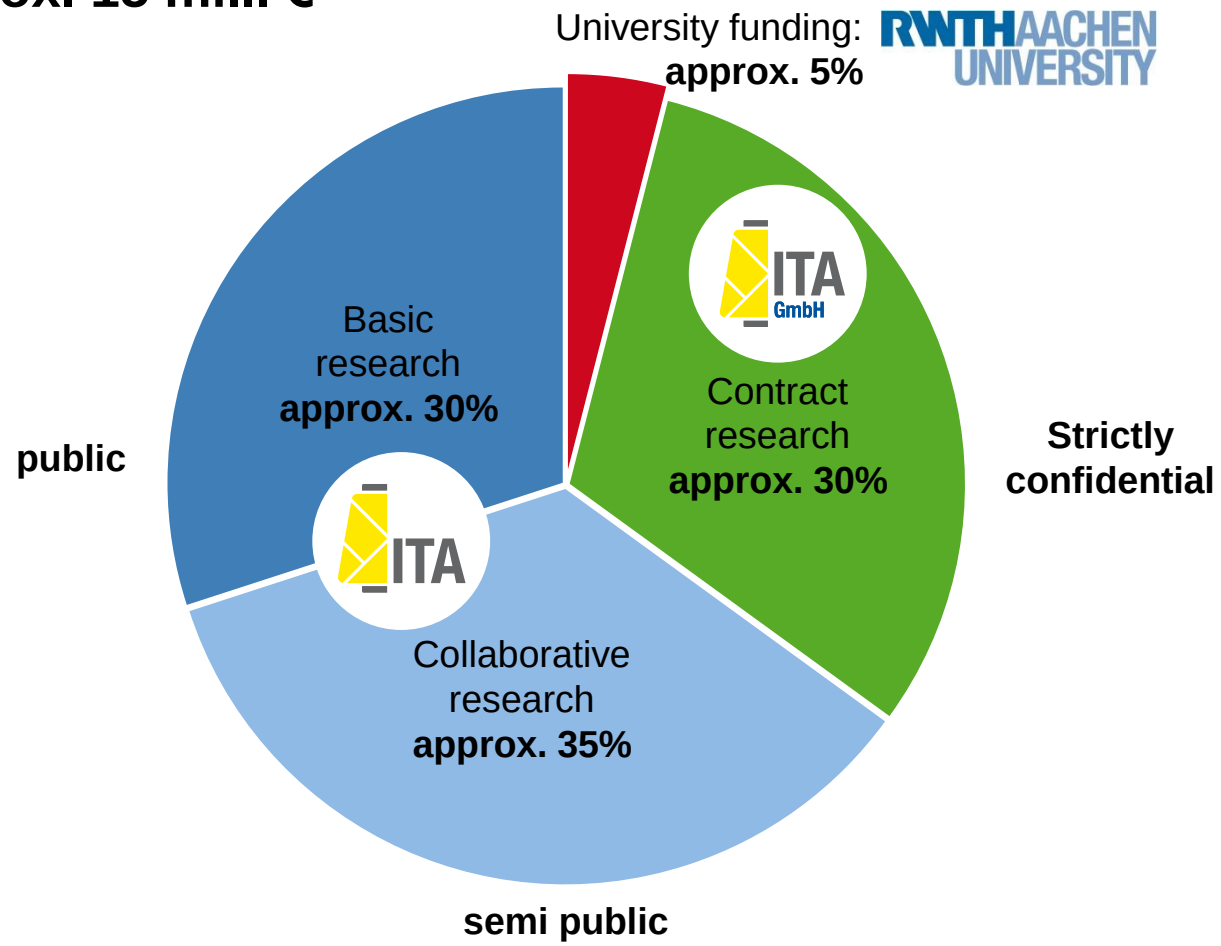
ITA

Personnel

- 110 scientists
- 65 technical and service staff
- 200 undergraduate research assistants
- 50 students, who major in textile engineering per year

ITA - Facts & Figures

Budget: approx. 15 mill. €



Infrastructure

Maschines, Laboratories, Buildings

- Technical centre with 250 textile maschines and test setups for all textile process levels from fibre to product
- Testing laboratories from polymer to textile
- Workshops for mechanics, electronics and software
- Buildings:
  - „INNOTEX“ with 4,000 m² (technical centre and office)
  - „Spinnturm“: 1,000 m² (technical centre for melt spinning)
  - „Centre für High Performance Fiber Materials“ CFM: 1,000 m² (especially carbon fibre production)
  - Additional offices in another building (Kackertstr. 9)
  - Different premises (offices and technical centres) in other establishements (in planning)

Our Team

Our mission statement

- We develop people, working on relevant innovations topics.
- We design innovative and cost-effective solutions with structured methods and creativity.

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Director of institute

Dr.-Ing. Bernhard Schmenk
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Head of coporate development and communication

Unsere Partner:

ITA TechnologieTransfer GmbH, Aachen

Institut für Textiltechnik Augsburg gGmbH, Augsburg

ITA Teknoloji Transfer Ltd. Sti., Bursa (Türkei)

Appendix

Equipment and competences

Appendix - Equipment

Machinery yarn production/structure

- Technical centre for spinning:
  - Melt and solution spinning from 10 g → 100 kg polymer
  - Technical centre for carbon fibres: precursor, stabilisation, carbonisation
  - High temperature and bico-systems, electrospinning (solution & melt)
  - Glass/basalt spinning machine
- Staple fibre yarn production plus preparation:
  - Opener, rubber condensor & frame, card, flyer, spooling and cleaning
  - Ring spinning, rotor spinning,
- Structure
  - Texturising (false twist, air, crimper)
  - Hybrid yarn processes (entanglement, OE-friction) and twisting

Appendix - Equipment

Machinery textile fabrics

- Weaving
  - Different gripper and air jet machines
  - Narrow fabrics (jacquard)
  - Multiaxial fabrics (open reed weaving)
  - Pattern warping machine
- Knitted fabrics
  - Various circular knitting machines (jacquard)
  - Various warp knitting and raschel machines (jacquard, spacer fabrics)
- Nonwovens:
  - Carding machine with crosslayer
  - Airlaid, Airlay (continuous und discontinuous)

Appendix - Equipment

Machinery for reinforcement textiles

- Reinforcement textiles (2D textiles)
  - Warp-knitted bi- and multiaxial fabrics
  - Knitting, tailored fibre placement (2.5 -D textiles)
- ITA-Preformcentre (3D textiles)
  - Different tools for handling, binder application, sewing and tufting, quality control
  - Cutter machine and ultrasound cutter
- Brading (3D textiles)
  - Circular braiding & 3D braiding for composites
  - Hexagonal- und small scale braiding machine for medical use
- Coating
  - Different coating systems plus in-situ polymerisation

Appendix - Equipment

Machinery for joining and other machinery

- Joining process/manufacturing
  - Different sewing machines
  - Welding systems (ultrasound, thermal)
- Others
  - Tribological test stand
  - Tow spreading test stand
  - Autoclave
  - Mould production for fibre composites

Appendix - Equipment

Measuring technologies

- Optical:
  - Digital photography and digital editing
  - Laser-Doppler anemometer (LDA)
  - Particle Image Velocimetry (PIV)
  - Fibre orientation, 3D deformation: Argus, Aramis, Apodius measuring systems
  - Highspeed camera
  - Thermal imaging camera
- Online measuring technologies:
  - Measuring sensors for yarn tension, fibre diameter, filament friction etc.
  - Hard- and software for high frequency real time recording of online sensors and process parameters plus visualisation

Appendix - Equipment

Laboratories

- Air conditioned textile testing laboratories:
  - fibres, yarns and fabrics
  - tensile, strength, bending test (up to 10 to), temperature chamber and video-extensiometer
  - Digital light microscopy plus sample preparation and ultra microtome
  - SEM, Micro-CT, TEM
- Polymer laboratories:
  - DSC-TGA, DMA, FT-IR, Gas-Pycnometer, rheometry, Karl-Fischer-titration
- Other laboratories:
  - Lamination of fibre composites
  - Mineral matrices (concrete)

Appendix - Equipment

Workshops

- Mechanical workshop
  - Machining plus 5-axle-CNC-milling
  - Welding
  - 3D print
  - construction
- Electrical workshop
- Software and network department

Appendix - Equipment

Software

- Modelling, simulation, numeric, evaluation:
  - CFD Computational Fluid Dynamics
  - FEM Finite Element Method and DEM (Discrete Element Model)
  - Neural network
  - Textile modeling Wisetex and GeoDict (from CT-Scans)
  - MatLab
- Construction
  - Autodesk Inventor