Breakthrough Steels and Applications (FIMECC BSA)

Industry-driven public-private research programme
2014-2018

http://www.fimecc.com/programs/bsa
Executive summary

- **FIMECC BSA** aims at securing the leading position of the Finnish metals and engineering industry
  - The programme answers to major global challenges and end-user needs by taking metals research and design to a new level

- **Essential elements:**
  - FIMECC Breakthrough Materials Doctoral school
  - Extensive collaboration both nationally (joint knowledge platform with Hybrid Materials programme) and internationally

- **Impact:** Renewed and successful Finnish metals and engineering industry based on innovative and sustainable solutions
  - Applications of the programme results will benefit various fields of industry
  - New business opportunities will be opened in new areas
  - An extensive international steel competence network will be created

- **Vision:** Finnish metals and engineering companies are key players in global cleantech markets by 2030
FIMECC BSA builds on the existing strengths to secure the leading position of the Finnish metals and engineering industry

Finland has a unique cluster of world innovation leaders both in novel steel products and many fields of engineering.

Previous technology programmes (Newpro, LIGHT, DEMAPP) have helped develop an exceptionally strong steel research infrastructure to Finnish Universities.

However, the rapidly changing global market and new megatrends call for renewal of the Finnish metals and engineering industry in order to remain competitive and in leading position.

BSA programme takes full advantage of the existing networks and momentum created in previous R&D efforts to maintain and develop knowledge advantage in these key areas.
The programme is driven by major global challenges and end-user needs.

- Steels are the largest group of materials – their superior qualities should and can be further developed based on end-user needs.

- Reducing energy and material consumption

- Solutions for new production processes and harsher application areas

- More efficient use of latest high performance steel developments

- Longer product lives, lighter-weight structures, increased life-cycle efficiency
The ambitious goals are tackled by modern materials science

<table>
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<tr>
<th>Goals</th>
<th>Methods</th>
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<tr>
<td>Creating optimal material solutions for emerging processes and applications</td>
<td>Simulation and analysis of production, fabrication and use of future advanced steel products and their applications to create optimized properties</td>
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<td>Developing specialised, life-cycle efficient breakthrough steels</td>
<td>Novel techniques, equipment and modeling tools for the development of advanced steels and for the evaluation of their performance</td>
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<td>Promoting efficient application of latest advanced (better performing) steel materials by establishing new design rules and tools</td>
<td>Fundamental research into the relationships between the microstructure and properties of advanced steels as affected by production, manufacturing and fabrication</td>
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Applications of Breakthrough Steels will benefit various fields of industry

- Building and construction
- Energy technologies
- Marine and offshore sectors
- Mining
- Automotive, transportation
- Lifting, handling
- Process and chemical industry
- Electronics industry
- Forest industry
- ...
FIMECC BSA brings materials research and design to a new level

- **First level**
  - Problem
  - Experiments
  - Conclusions, case limited

- **Second level**
  - Understanding
  - Characterisation
  - Conclusions, case limited

- **Third level**
  - Theory
  - Experiments
  - Conclusions, generic

- **Forth level**
  - Modelling & simulation
  - Experiments
  - Conclusions, generic, prediction

Validation arrows indicate the flow of information and validation processes between the levels.
The BSA R&D effort is driven by the need to be competitive and open up new business opportunities

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<th>Need</th>
<th>Ambition</th>
<th>Outcome</th>
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<tr>
<td>• Remove barriers to application of latest steel developments</td>
<td>• Spearhead knowledge utilized by entire steel value chain and end-users</td>
<td>• Novel applications and new business</td>
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<tr>
<td>• Develop economically and environmentally better steels</td>
<td>in various application areas</td>
<td>• New specialised, life-cycle efficient steels</td>
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<td>• Create new solutions for emerging application areas</td>
<td>• Novel design competence and tools to radically decrease the time to</td>
<td>• Completely new breakthrough material solutions</td>
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<td>market and digitalize the development process</td>
<td>• World-leading steel-competence network</td>
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*Picture: Metso Oyj*  
*Picture: TUT*
Impact: Renewed and successful Finnish metals and engineering industry based on innovative and sustainable solutions

Major change in Finnish metal and engineering industry’s structure and producing capability

New business opportunities in emerging and growing industry sectors like bioenergy, clean water, mining, transport and arctic technologies
BSA vision 2030:
Finnish metals and engineering companies are key players in global cleantech markets

Globally

- Shortage of clean water
- Shortage of raw materials
- Energy costs increased threefold
- 40% reduction in CO2-equivalent footprints
- Advanced steels are recognized as the main building block of sustainable societies
- Steel products and structures using 30% less steel than today are in high demand

In Finland

- Companies provide sustainable technologies for energy production, water treatment and green technologies
- Engineering and metal companies have strengthened their world-leading position having invested in the application of advanced steels and design tools
- The above developments have opened completely new markets for advanced steels and fostered growth of SMEs
- Steel producers and foundries have differentiated from their global competitors by changing their offerings to knowledge-intensive products
- High number of engineers skilled in the use of world class design techniques and computer simulation tools needed for the efficient use of steel
BSA creates an extensive steel competence network, integrating complete value chains

Value chain
- Material producers
- Equipment manufacturers
- Equipment users

Industry challenges
- New steels
- More efficient use of new steels
- Material solutions for emerging applications

Key competence areas and research partners
- Material and multiscale modeling
  - Physical metallurgy
  - Structural design of steel structures
  - Material performance and testing

Supplemented by:
- BSA international research partners
- Existing national and international R&D networks and initiatives of BSA participants (Academy of Finland, RFCS, EU projects, etc.)
Facts sheet: BSA

- Timetable: 5 years, started 1.1.2014
- Volume: 46 M€ total (8 M€ first year)
- Participants:
  - 30 companies including engineering and machinery industries with a wide range of applications, steel producers and foundries.
  - 7 research organisations including several multidisciplinary research groups with high level international partners.
The BSA consortium involves 30 companies and 7 research organisations
BSA – optimum balance of market pull and technology push

Project 1: Material challenges from emerging processes and applications
Solve material challenges set by new technologies

Project 2: Design beyond present codes
Enable efficient utilisation of new materials

Project 3: Novel steel concepts
Develop new materials enabling sustainable solutions

Project 4: Fundamentals and modeling
Cross-cutting element ensuring sharing and integration of tools and knowledge developed
A joint fundamentals and modelling project will create a solid knowledge platform

Generic Platform Modelling tools & Optimal material design

Doctoral projects linked to industrial projects:

BSA

P1-P3

HYB-RIDS

P1-P4

State-of-the-art

"Fimecc Breakthrough Materials Doctoral School"
FIMECC Breakthrough Materials Doctoral School solves industrial challenges with deep science

- **Industry-led Doctoral School which has been built within FIMECC BSA & HYBRIDS programmes**
- Launched in the beginning of 2014
- Involves 22 doctoral students in its first phase (extended already to 30; all working within BSA&HYBRIDS)
- Focusing on fundamental scientific challenges and modelling, a multi-disciplinary group of young scientists with their senior advisors and international partners will tackle critical research questions set by the involved companies to build new solutions and relevant competence for the industry
- Doctoral studies are carried out according to the principles of each university
- More information and Doctoral school in the media: FIMECC’s industry driven doctoral school brings materials research to new era
FIMECC BSA&HYBRIDS together are a major boost to the materials & engineering sector

- Two systematically built parallel programmes linked to each other
- Strong co-operative R&D effort
  - 30 + 38 companies, all key universities + top-notch international partners; a total volume of 80 MEUR (46 + 34)
- Extensive expert networks
  - Gathering together wide, multi-disciplinary expert groups from different industries and academic branches
- Ambitious plans & crew to make it happen
  - Combining deep science and real industrial needs
  - New critical solutions and relevant competence for the industry
  - “FIMECC Breakthrough Materials Doctoral School” (see previous slide)
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FIMECC Ltd. (Finnish Metals and Engineering Competence Cluster) is an open innovation R&D company. The aim of FIMECC is to increase and deepen the cooperation between companies, universities and research institutes in R&D. FIMECC is the right cooperation partner for any organization willing to co-create knowledge through strategic pre-competitive research. All those who are willing to contribute significantly to our focus areas, are welcomed. Current list of shareholders can be widened through new shares issued for those willing to buy.

FIMECC manages research in five strategic research themes through research programs that address specific issues and research questions mentioned in the Strategic Research Agenda.

More information about FIMECC Ltd.:
www.fimecc.com
We boost strategic research - together

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