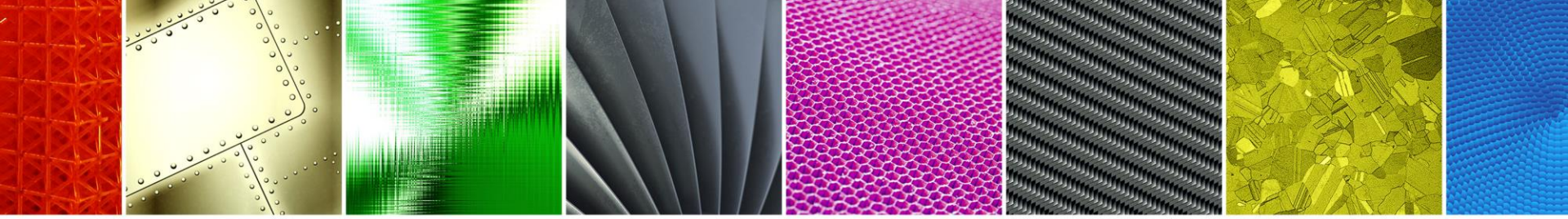


Introduction to Granta Design
&
CES EduPack software for Teaching

Lille, MMATENG Project, 29 May 2017

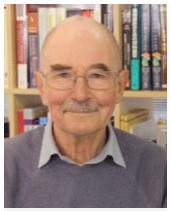
GRANTA
MATERIAL INTELLIGENCE

www.grantadesign.com

Granta Design Network – innovating since 1994

GRANTA

Founders



Prof. Mike Ashby

Prof. David Cebon

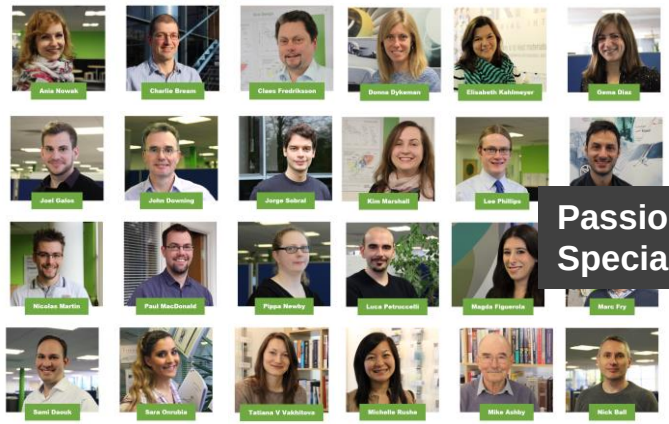
Long-term stability

S rs

UNIVERSITY OF CAMBRIDGE

ASM INTERNATIONAL

Education Team



Passion for Education
Specialist Knowledge

Academic Collaborators

Clients across Academia and Industry

Knowledge of the latest pedagogical trends
Feedback

Knowledge of the latest industrial trends
Case Studies

Our network: example partners and collaborations

GRANTA

Owners

UNIVERSITY OF CAMBRIDGE

ASM INTERNATIONAL

Software

Altair

ANSYS

Autodesk

DASSAULT SYSTEMES

PTC

SIEMENS

Data

ASME SETTING THE STANDARD

CAMPUS

Global Powder Metallurgy Property Database

IHS

M-Base Engineering + Software

MI-21 Metals Information For the 21st Century

MMPDS

NCAMP

NIMS

Stahl

UL

Computation

CMDNetwork

Collaborations

ADS

AMAZE

Ac Ce Le Ra Te D
Me Ta L Lu Rg Y

ELLEN MACARTHUR FOUNDATION THE CIRCULAR ECONOMY 100

Education

SEFI

FEMS

What do we develop?

GRANTA

Materials education

GRANTA CES EDUPACK + GRANTA Teaching Resources

Research and consulting

GRANTA CES SELECTOR + GRANTA CES CONSTRUCTOR

Materials information management

GRANTA Mi

Teaching and Research

Hochschule Reutlingen Reutlingen University, PENNSTATE, KU LEUVEN, Tecnológico de Monterrey, Georgia Institute of Technology, MANCHESTER, ROCHESTER, Carnegie Mellon University, MIT, ETH, BCIT, KIT, UNIVERSITY OF CAMBRIDGE, TU Delft, PRINCETON UNIVERSITY, ILLINOIS, CHALMERS, KTH, THE OHIO STATE UNIVERSITY, Imperial College London, UF UNIVERSITY OF FLORIDA, EPFL, MichiganTech Create the Future, University of Waterloo

Research Labs and Industry

AIRBUS, GE, BAKER HUGHES, SULZER, DePuy a Johnson & Johnson company, NPL National Physical Laboratory, esa, NASA, JAGUAR, LAND ROVER, EMBRAER, LOCKHEED MARTIN, GM, Los Alamos NATIONAL LABORATORY EST. 1943, PHILIPS, ROLLS ROYCE, BOEING, ALCOA, Honeywell, EMERSON

Materials Education Symposia

UNIVERSITY OF CAMBRIDGE

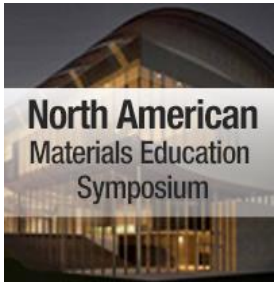
GRANTA

School of Materials Science & Engineering

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

NUS National University of Singapore

Department of Materials Science & Engineering



10th International Materials Education Symposium
University of Cambridge, UK, April, 2018

8th North American Materials Education Symposium
Massachusetts Institute of Technology, USA, August 24-25, 2017

3rd Asian Materials Education Symposium
Singapore University of Technology and Design, December, 2018

www.materials-education.com

Who uses CES EduPack?

What is CES EduPack?

Data for materials and processes

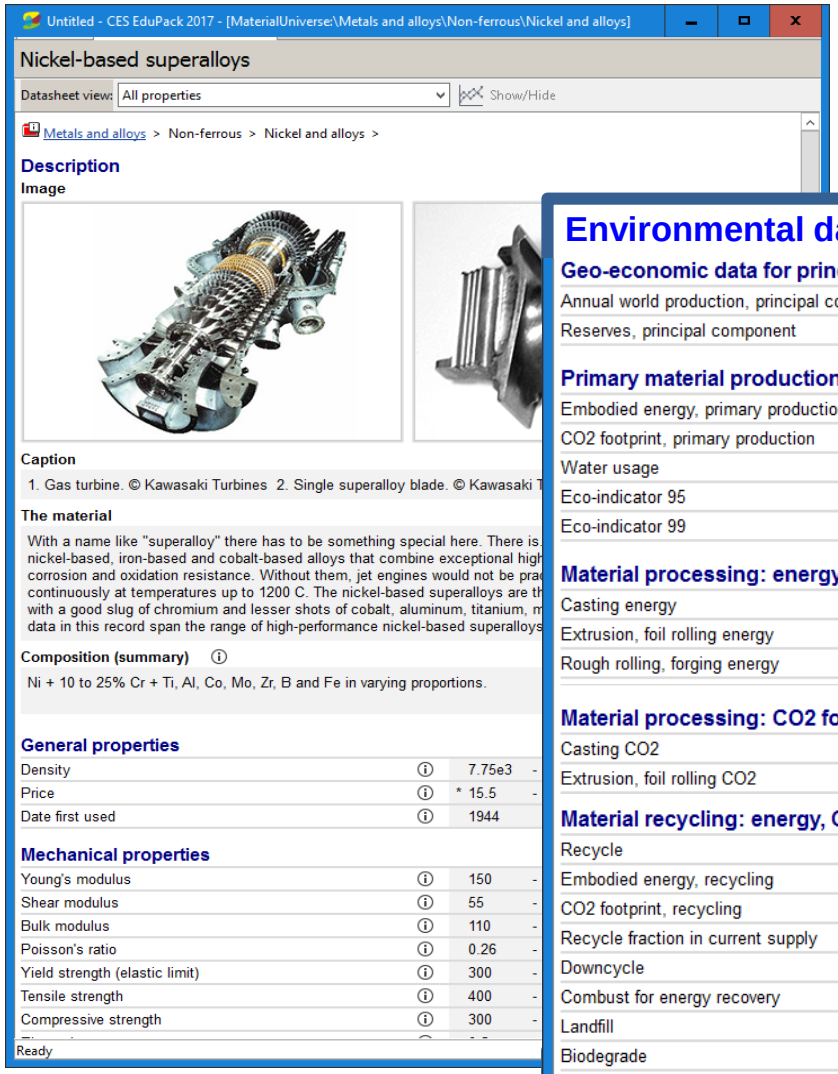
Tools to explore:
Data
Selection
Eco-design
Design of hybrids (composites, sandwich panels …)
Cost estimation

Teaching & Learning **resources**: Case Studies, PowerPoint units, White papers, Training … Exercises, Teach-yourself units, Interactive Glossary…

Material Data: reliable, relevant, comparable

Material attributes

- Images, Description
- General properties
- Mechanical
- Thermal
- Electrical
- Durability
- Environmental



Levels 1 and 2

- For 1st, 2nd year teaching

Environmental data

Geo-economic data for principal component		
Annual world production, principal component	1.43e6	tonne/yr
Reserves, principal component	7.1e7	tonne
Primary material production: energy, CO2 and water		
Embodied energy, primary production	* 232	MJ/kg
CO2 footprint, primary production	* 13.7	kg/kg
Water usage	* 345	l/kg
Eco-indicator 95	5.2e3	millipoints/kg
Eco-indicator 99	2.83e3	millipoints/kg
Material processing: energy		
Casting energy	* 10.5	MJ/kg
Extrusion, foil rolling energy	* 8.42	MJ/kg
Rough rolling, forging energy	* 4.36	MJ/kg
Material processing: CO2 footprint		
Casting CO2	* 0.786	kg/kg
Extrusion, foil rolling CO2	* 0.632	kg/kg
Material recycling: energy, CO2 and recycle fraction		
Recycle	✓	
Embodied energy, recycling	* 38.2	MJ/kg
CO2 footprint, recycling	* 3	kg/kg
Recycle fraction in current supply	23.9	%
Downcycle	✓	
Combust for energy recovery	✗	
Landfill	✗	
Biodegrade	✗	
Toxicity rating	Slightly toxic	

Process Data: reliable, relevant, comparable

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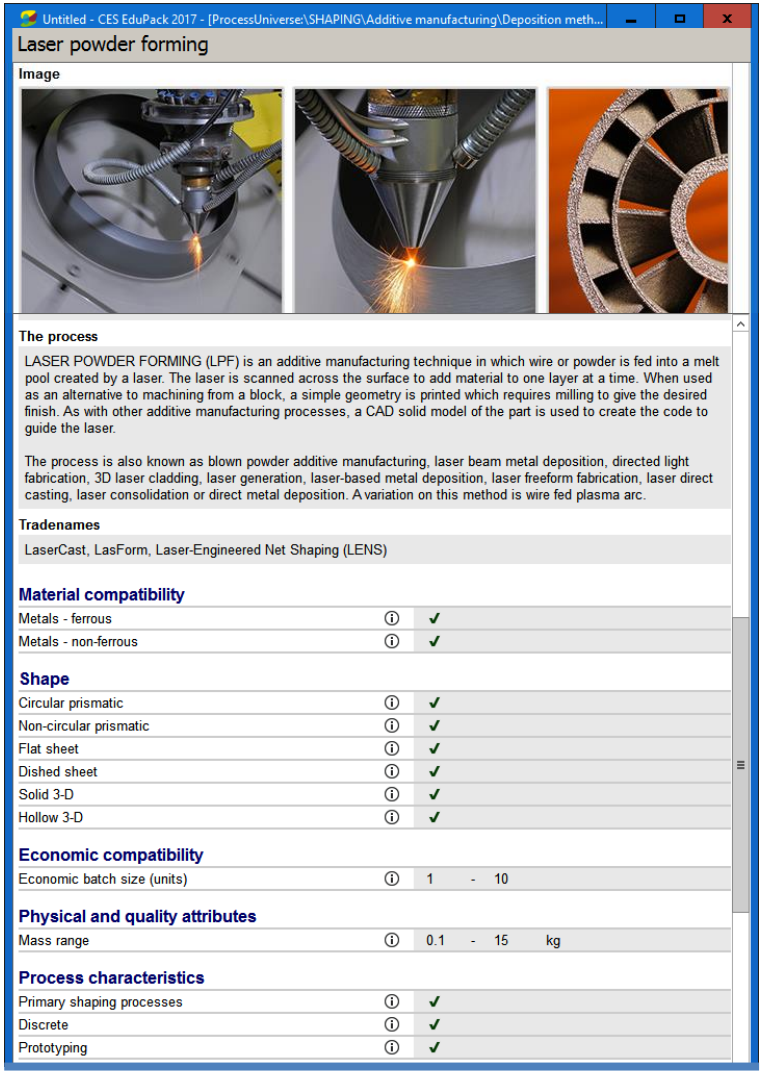
Process attributes

- Images, Description
- Compatible materials
- Shape
- Economics, with cost model

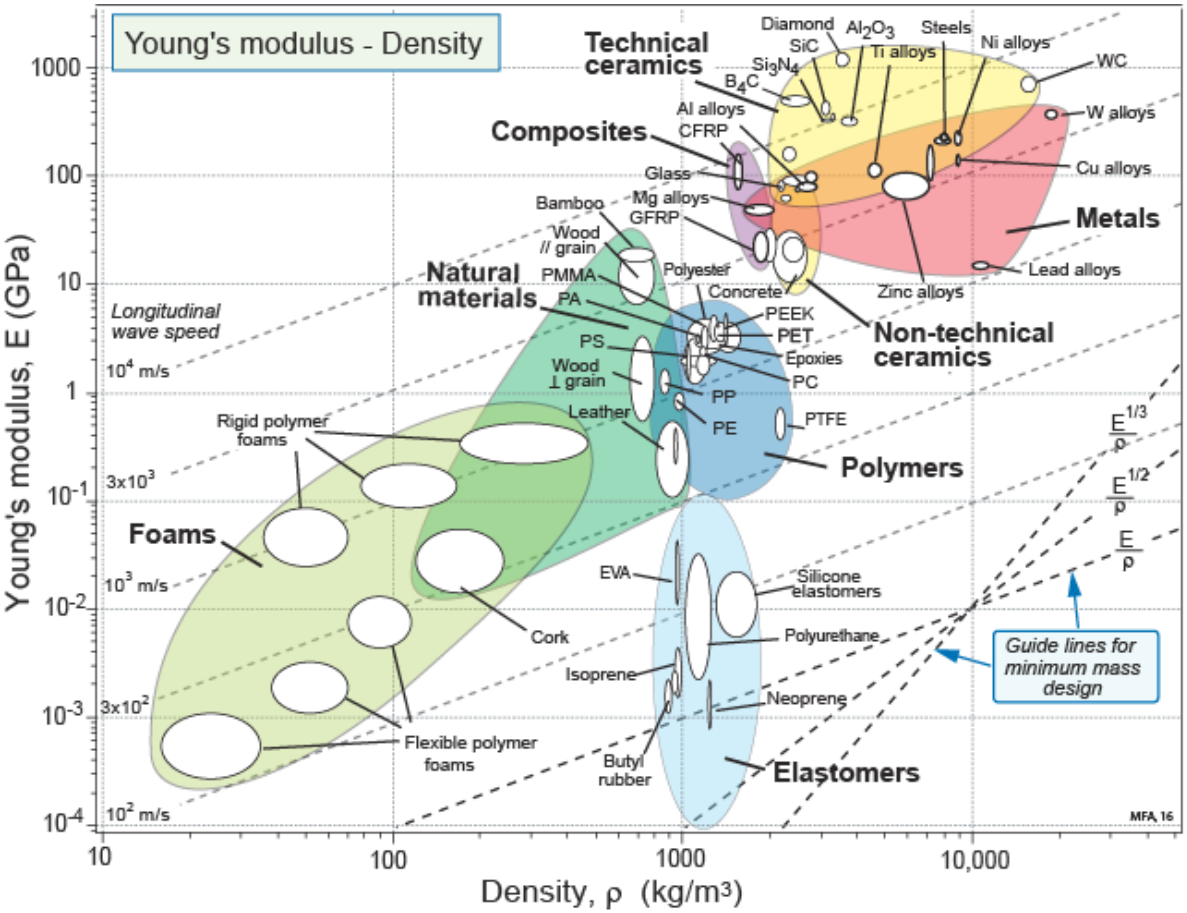


All levels

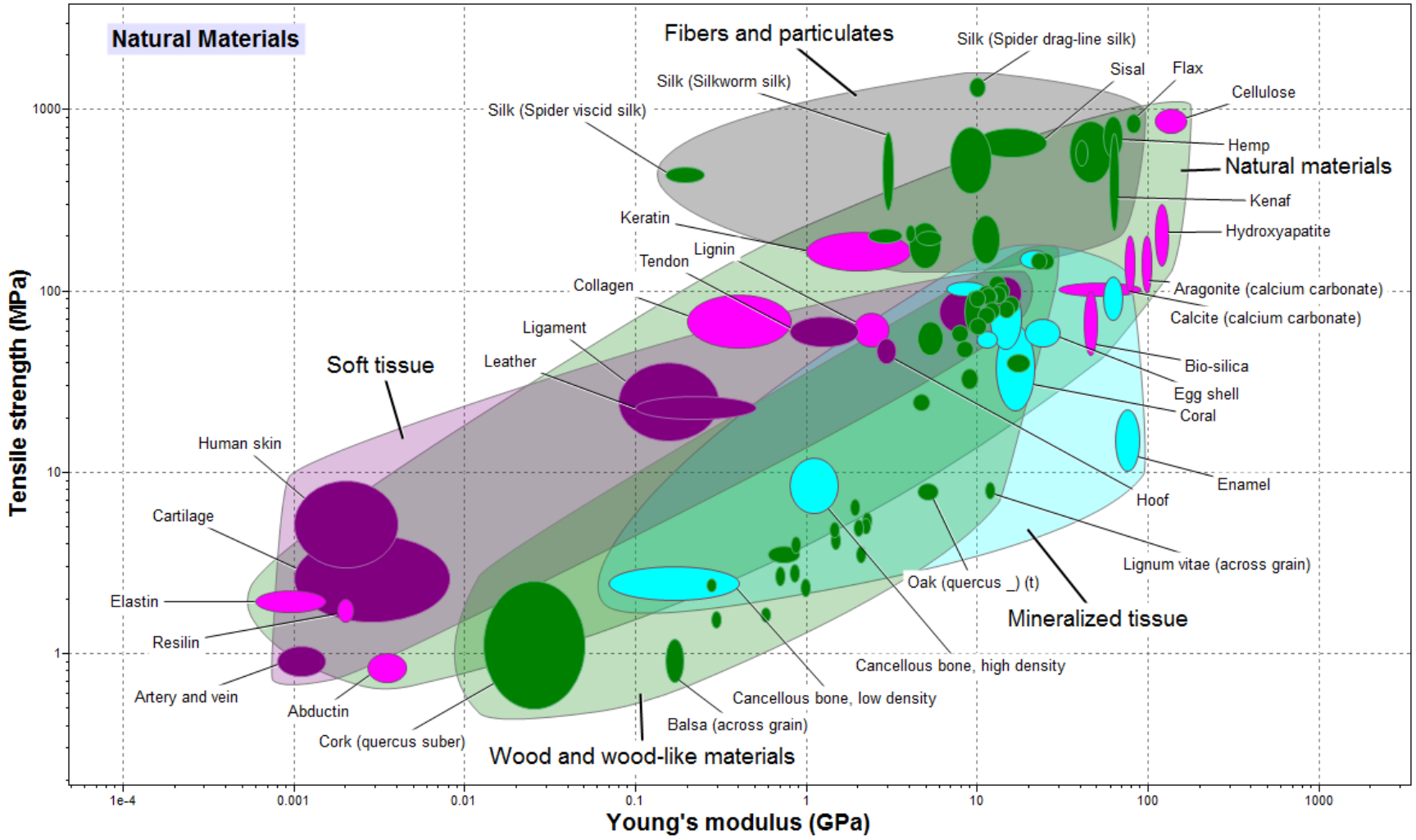
- > 100 shaping, joining and finishing processes
- Schematics and images
- Links to records for compatible materials

Data Visualization

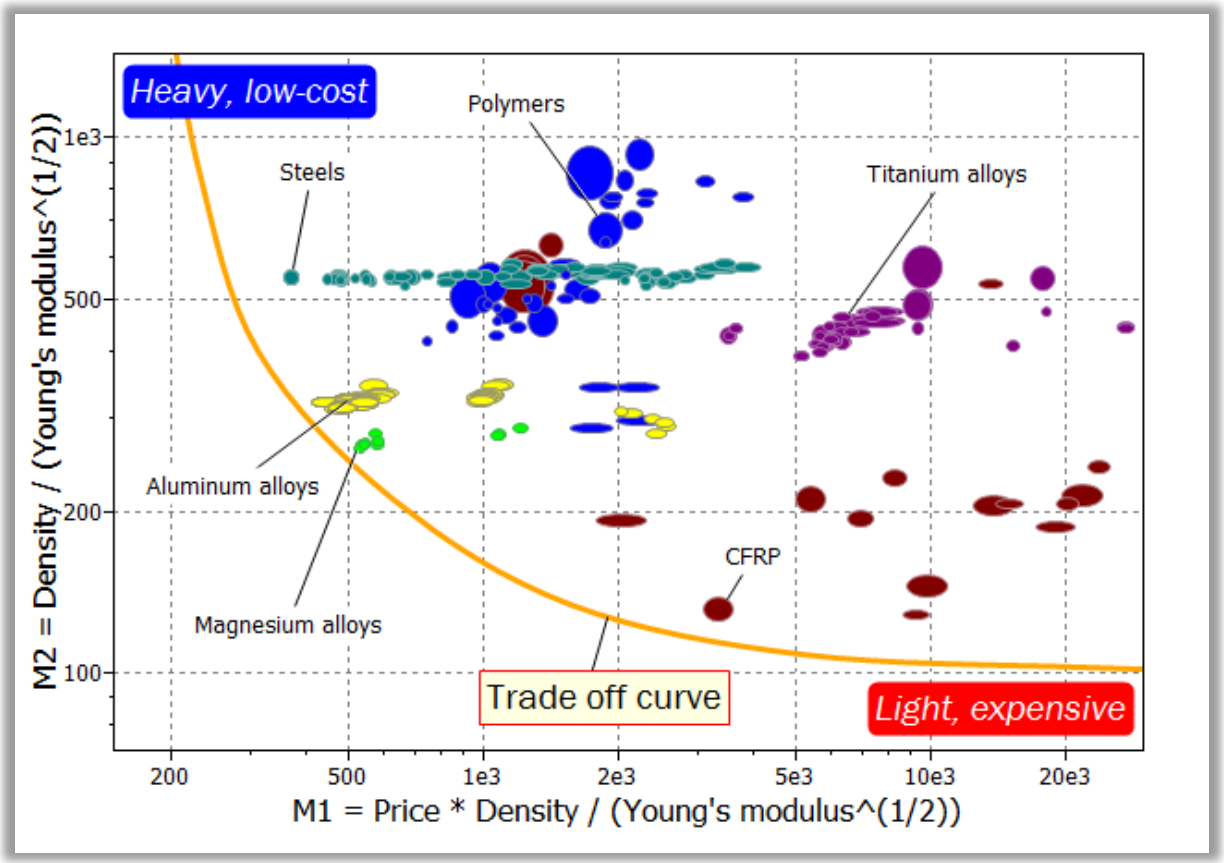
Create Interactive Charts



Example of materials in Bioengineering



Explore trade offs

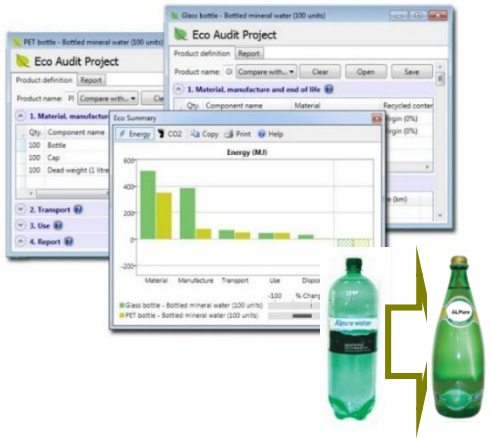


Other tools

Eco-Audit Tool

Introduces the students to key concepts in Eco-Design

(quickly calculates the energy and carbon footprint of products)



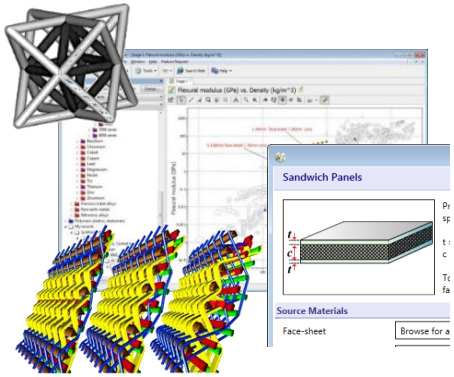
Available in all levels except Bio Engineering

Synthesizer Tool

Hybrid Synthesizer

Estimate the properties of composites and hybrid materials

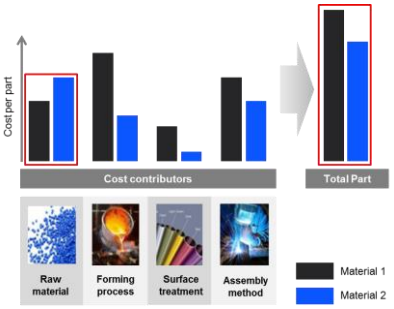
(sandwich panels, cellular structures and composites)



Part Cost Estimator

Quickly estimate the cost to manufacture a component

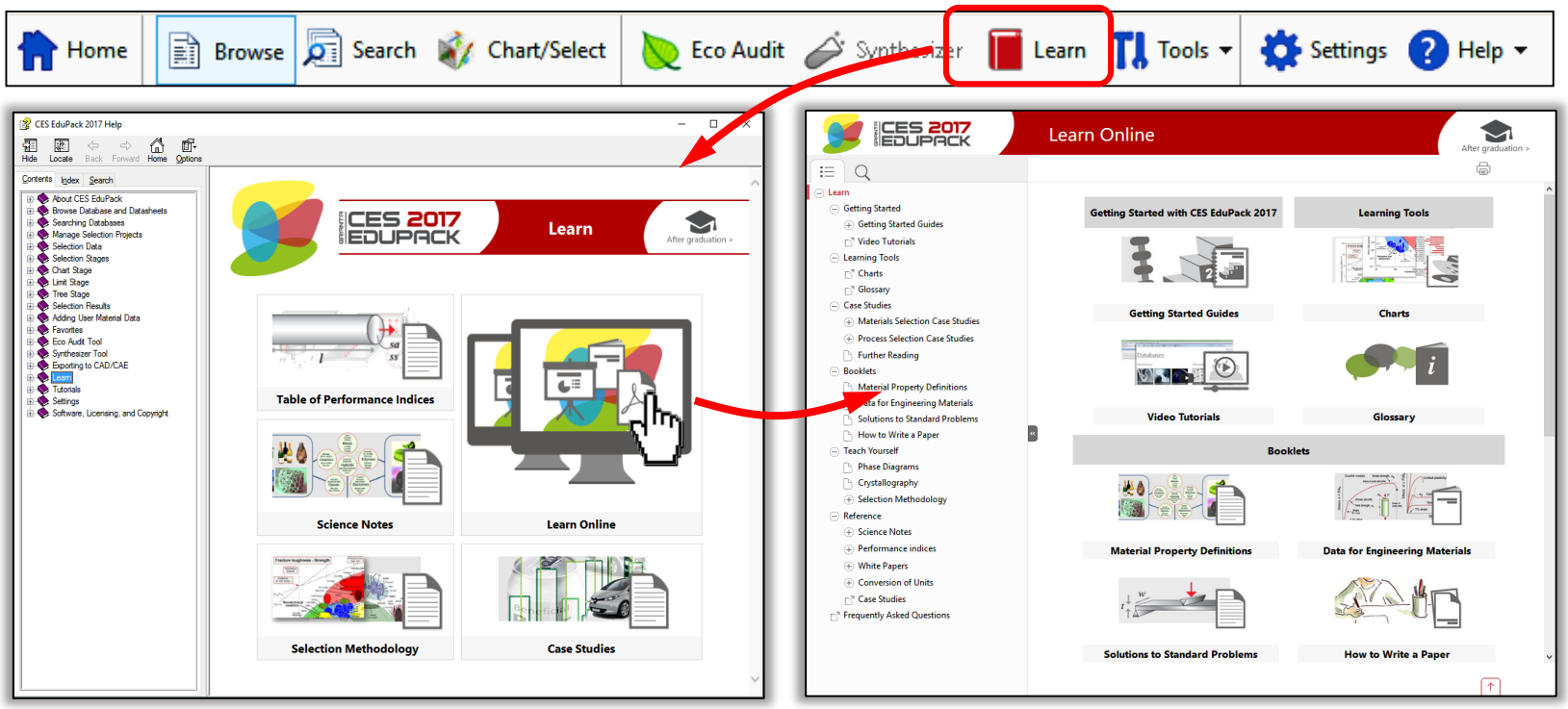
Compare different classes of materials and processing routes



Only available in Level 3: Aerospace, Polymer, Energy, Eco Design, and Sustainability

Teaching and Learning Resources

Learning resources to engage students



Education Hub – Hundreds of Teaching Resources

GRANTA

Paper: The Elements Database

Claes Fredriksson, Kyozo Arimoto, Mike Ashby | Granta Design

Exercises: Sustainable Development (Lecture Unit: "What is a Sustainable development")

Mike Ashby | Granta Design

Exercises

Case Studies: Sustainable Development Project - Electric Cars

Problem-based learning resources

Paper: Teaching Materials with CES EduPack

Hannah Melia, Magda Figuerola, Claes Fredriksson | Granta Design

Video

Why is MATERIALS EDUCATION important?

Video: CES EduPack Training Session 1 - Getting Started

Hannah Melia | Granta Design

Videos

Paper: Manipulating Properties: Charts, microstructure and processing

Hugh Shercliff, Mike Ashby | Dept of Engineering, Cambridge University

Papers

Exercises: Bio Engineering (Lecture Unit: "Teaching resources for Bioengineering")

Mike Ashby, Ana Pereira | Granta Design

Glossary

Student resources

Video: CES EduPack Training Session 4 - Trade-offs

Claes Fredriksson | Granta Design

Advanced Training

Contributed Lecture: Materials for Turbochargers

Dr John Robertson-Begg | University of Derby

Contributed resource

Case studies: CES Selector - Rational Material Selection for a Medical Forceps

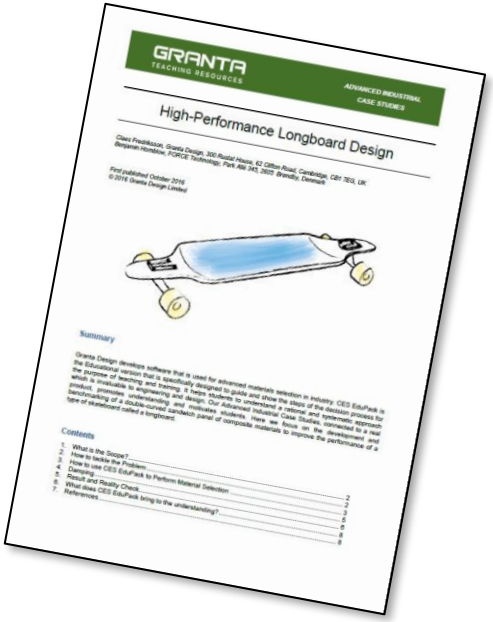
Sarah Egan, Jorge Sobral | Granta Design

Case Studies

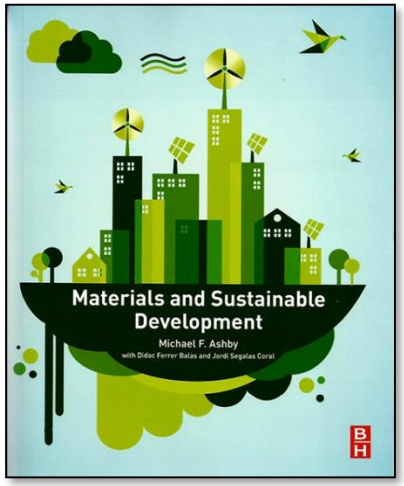
Advanced Industrial Case Studies

More Advanced Case Studies 2017

Planned: Mars Lander, Bone Porosity, …

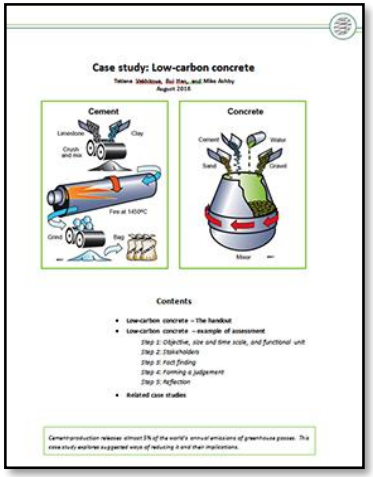


Granta's Sustainability Teaching Resources

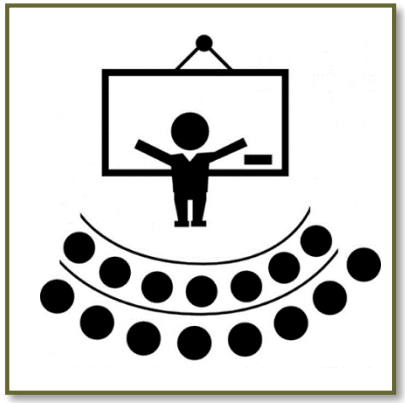


Teaching text

Teaching resources



8 Case studies



Webinars, Workshops

Database

Handouts, Projects

Advanced Databases

GRANTA

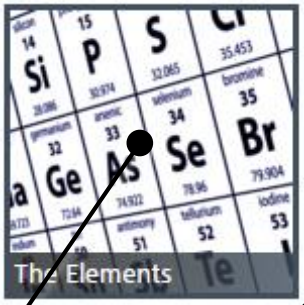
Bio Properties Biological Biomedical and Bio derived Materials

Architectural Materials and Properties

MMPDS & CMH-17 Temp. dependent data

Nations of the world, Legislation & regulation, Critical materials

Levels 1&2 - Introductory



Level 3 - Advanced

Periodic Table

Environmental Properties

Traceable data

CAMPUS & Prospector Plastics ('IDES')

Bio Properties Link to ASM Medical Dev

Granta & TEMPUS MMATENG

- **Special agreement, allowing the access to teaching software CES EduPack to Universities – MMATENG participants from Russia, Ukraine and Israel for 3 years.**
- **Provision of trainings for academics from the participating Universities:**
  - Project's meeting in Leuven
  - Project's meeting in Krakow
  - Project's meeting in Kiev (on-line presentation)
  - Monthly on-line Webinars for users of CES EduPack
  - Access to 350+ Teaching Resources on Granta's Education HUB on-line: https://teachingresources.grantadesign.com/
- **Special offers for software renewal & participation in Materials Education Symposia (Europe, USA, Asia)**

Feedback Form/Stay in Touch:

- **KIT short course 27 July 2017:**

http://www.grantadesign.com/education/events/2017/KIT2017/index.htm

Code for your KITEARLY

- **Cambridge Materials Education Symposium APRIL 12-13, 2018**

https://www.materials-education.com/2018/cambridge/index.htm

Loyalty discount upon request

Contact Details:

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for Central and Eastern European Region

Eco Design & Sustainability Consultant

Education Division Granta Design

Tatiana.Vakhitova@grantadesign.com