

Managing composites information to enable lightweighting projects

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Lightweighting is a major motivating factor in many industry sectors, with composites technology playing a key role. Success requires excellence in the use of materials information. Engineering enterprises pursuing weight reductions in order to minimize costs, meet stringent environmental regulations, or optimise performance standards are constantly looking to use new materials, or to make smarter choices with existing materials. They must capture and manage data about these materials, analyse this data (often comparing it to respected reference data) in order to generate useful information, and apply this information to select or substitute materials, having made comparisons across material classes. This process poses some difficult challenges. But these are challenges being met by leading engineering organizations such as RUAG Space, Airbus Helicopters, Designworks, and Vestas – with positive results.

The materials information challenge

Capturing and managing a company's materials information is inherently difficult. This data is complex, specialised, and typically distributed across an organization in teams dealing with testing, research, quality assurance, and design. Effective materials

Materials information management is vital for enterprises striving to achieve success in lightweighting projects. Success often depends on an organization's ability to capture and manage high volumes of complex composites data, and make comparisons with reference data and across material classes.

information management requires collation from multiple, ever-changing sources. Data is constantly updated as further testing is performed or as new or improved materials become available. Without one consistent "gold source" of data that is accessible in a controlled manner to the relevant engineers, designers and technicians, time is wasted finding the right data. One survey found that 50% of expensively-gathered materials knowledge is not re-used, and that staff often duplicated previous work [1].

These standard materials information problems can be more acute for lightweighting

projects, which often involve thinking about different material classes (e.g., replacing a metal with a composite) and making innovative uses of these materials. Lightweighting tends to require information from more diverse sources (perhaps, different research groups) and it is more likely to require new and dynamic information.

Composites are often key to this innovation, providing an unrivalled combination of strength and light weight for many applications. But composites data is particularly challenging to manage and use, due to the multi-component nature of these materials

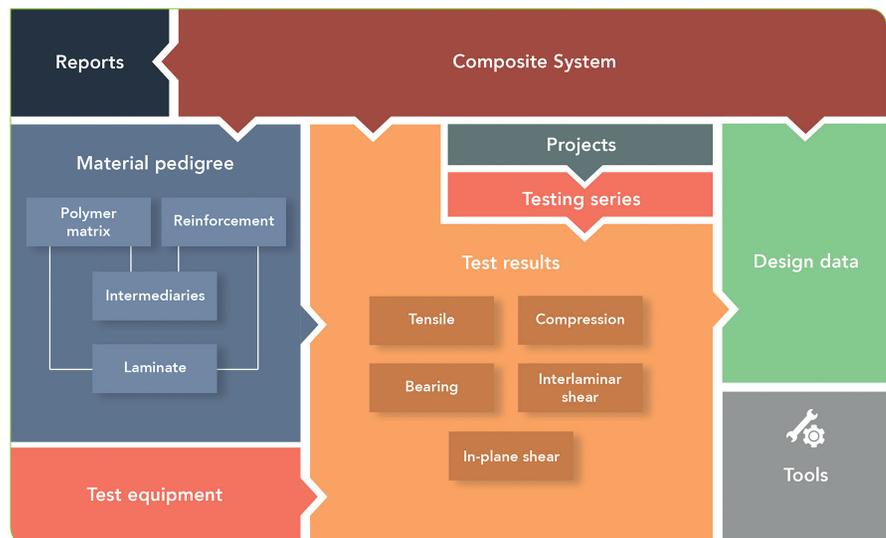


Fig. 1: Using best-practice data structures with the GRANTA MI:Composites Template

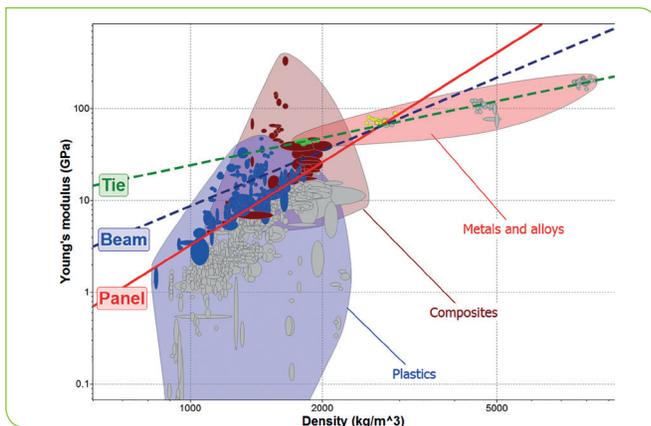


Fig. 3: Assessing materials performance for lightweighting. Lines indicate materials with a similar weight for a given stiffness, showing how this varies for different applications

information management for the project, capturing high-quality, pedigree-assured composites data and enabling the use of this data for finite element analysis (FEA).

Making smart decisions

Of course, good materials information only has value if it is applied. In lightweighting projects, this often means using it to choose materials. But it can be difficult to make valid comparisons across different material classes. Cross-class materials selection often takes engineering teams out of their “comfort zone”. To have confidence in exploring options, they need not only the best available in-house information, but reference data to “fill the gaps” in their picture of materials property space. And they need systematic tools to use this data in making informed decisions. These tools need some “material intelligence”, since performance is often determined by complicated combinations of material properties (figure 3).

Designworks, a BMW Group subsidiary, provides consultancy and design services to the automotive sector and a diverse range of other industries with a focus on mobility. The work of the team of materials scientists, automotive and product designers, engineering experts and sustainability consultants is geared towards innovation, with lightweight solutions being one of the key priorities. When working on a seat concept for the rail industry, Designworks was able to reduce weight by 25% with considerable financial benefits. The company is using GRANTA MI to manage and integrate its

materials knowledge, and also uses the CES Selector™ software to aid materials selection. CES Selector can screen the “universe” of available materials to identify candidates for an application. It provides a database of comparable, gap-free data for all classes of engineering materials, plus graphical tools based on the rational selection methodology developed by Professor Mike Ashby at the University of Cambridge [4] to filter this data and identify optimal materials choices. While details of companies’ design projects are often confidential, it is possible to describe typical problems solved through materials selection studies carried out by Granta Design [5]. A potential weight saving of 70% was identified by replacing steel with continuous fibre-reinforced composites in a high-performance drive shaft. And for an automotive transmission cross-beam, a glass-fibre-filled polymer would be 40% lighter and 20% cheaper than a cast aluminium alloy (figure 4).

Effective materials information management for lightweighting success

These case studies demonstrate the importance of good materials information management and this is being used in organizations where lightweighting is a key target, and composites are a key technology. Substantial weight savings, cost savings, time savings, and the opportunity for greater understanding and insight can be achieved. These projects have in common the use of the GRANTA MI software, which has

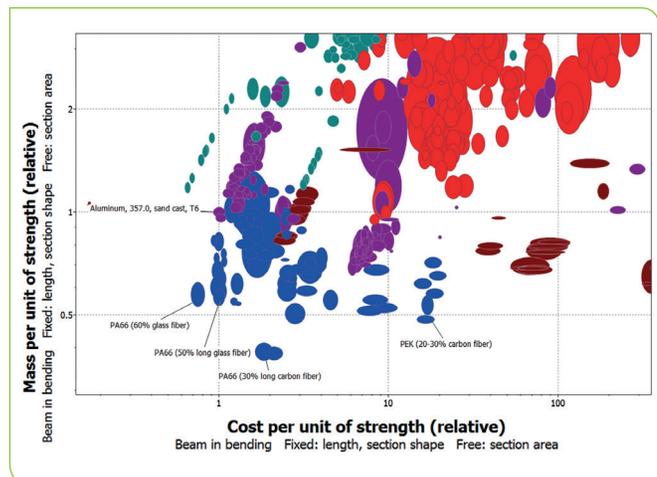


Fig. 4: Automotive transmission cross-beam selection chart

become the industry-standard software for systematic materials information management. The GRANTA MI:Composites package meets the special challenges of managing large quantities of complex composites data, and access to the authoritative NCAMP reference data eases the process of composites qualification and equivalency. The related CES Selector adds graphical tools for cross-class comparison and selection of materials. Granta’s combination of software and powerful analytical tools allows enterprises and consortia to manage materials knowledge, combining data and information to enable them to make better decisions across material classes, so they can push materials harder to develop the lightweight solutions they need to gain a competitive edge. Materials information, if well managed and applied, can tip the scales in favour of lightweighting success. ■

References

- [1] Industry Survey on Materials Information Technology, Granta Design Ltd., 2012
- [2] Web seminar, 2013, www.grantadesign.com/webseminars/2013/wind.htm
- [3] Web seminar, 2013, www.grantadesign.com/webseminars/2013/composites/
- [4] M.F. Ashby, *Materials Selection in Mechanical Design*, 4th Edition. Butterworth Heinemann, 2011
- [5] CES Selector case studies, www.grantadesign.com/products/ces/casestudies.htm

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