Ansys

WHITE PAPER

How to Efficiently Solve the Materials Data Management Challenge for Design and Simulation

With the ever-increasing need for rapid product development, companies are trying to optimize the time their engineers spend on each step of the product development process. This includes increasing teams' efficiency and minimizing the number of design iterations. To achieve this, design iterations should happen as quickly as possible with the goal of improving the product, and not to correct errors introduced in the design. While sources of errors and wastes of time have many origins, this paper focuses on the ones related to materials information. We will discuss the current challenges associated with materials data management for design and simulation, and how to implement best practices to overcome such challenges.

Materials data is used at various stages of the product development process. For example, a designer can assign a material to a component in CAD so that it can be used in a weight roll-up, or a simulation analyst can assign a material model in CAE to run a simulation. To achieve this in a timely manner and with minimal risk of introducing errors, designers or simulation analysts must be able to find the "right material data" and to use it in the CAD or CAE work environment. The right material data often has more than one meaning:

- A material that is still available on the market, or that originates from a preferred supplier.
- A material for which the data set is complete and for which all teams involved in the product development have the properties they need.
- A material that is the least expensive of all available materials, the lightest, the strongest, etc.

Integrating materials information in the product development process is still difficult in many companies. What are the challenges they face and what can be done about it?

/ The Challenges of Materials Information

Traditionally, materials information was siloed, with each team or individual managing their own data set. Because of this, finding the right material data can be challenging as all information required to make an informed material choice is in various locations.

While having the information at hand is the first challenge, having the tools to make sense of the information is another one. Choosing the optimal material for a product requires comparing materials and their properties. Not all formats are suitable for this (e.g., how do you compare all materials you found on the internet?).

With a material chosen and with all the required data available, companies then must ensure that their designers and simulations analysts are able to use this data where they need it in their work environment. With information stored in various formats and being used in multiple software, reformatting the data for use is often a lengthy, error-prone process.

Finally, materials information is not static. Over time, data might evolve when new information is received, materials are no longer on the market or a company's strategy changes to favor some materials over others.

In summary, enabling designers and simulation analysts to use the right materials data the first time implies that all materials information is:

- Accessible to everyone.
- Comparable.
- Integrated.
- Controlled and maintainable.

Costs associated with uncontrolled materials information can either be direct costs due to lower productivity or missed opportunities to save on spending. Examples include:

- Using inconsistent or incorrect data in simulation and design, leading to failed design iterations or to quality or warranty issues if the errors are not identified in time.
- Spending time searching for or correcting data, resulting in delays and reducing the ROI on simulation investments.
- Letting designers use similar materials from too many different suppliers, reducing purchasing efficiency.

/ Traditional Solutions

Having silos of information often results from how the data was initially captured and subsequently maintained. For example, some individuals initially collected data from separate sources of information and did not share what they found with other teams. It could also be that individuals started with the same data, but it was modified by one party without informing the other. Over the years, companies have tried to overcome these challenges by using tools they already had at hand to limit the spread of silos of information: shared spreadsheets, material cards on a shared network, native database systems of CAD/CAE software, etc. Even these methods do solve some of the challenges, they usually present their own issues as well.

Let's compare some of the more common solutions:

- Shared spreadsheet: Materials information is saved in spreadsheet stored in a shared location.
  - Benefits:
    - Consistent data is available to everyone.
    - Spreadsheets generally enable simple filtering and comparison.
  - Issues:
    - Comparison of curves might require a lot of manipulations to select the data to compare.
    - When the data is to be used in CAD or CAE software, it must be formatted. This process is often manual.

- Material cards on a shared network: Materials information is saved as material cards (text files) in the proper format to be used in CAD or CAE software, in a shared location.
  - Benefits:
    - All materials information is available to everyone.
    - Materials data is ready to be used in CAD or CAE software.
  - Issues:
    - Finding materials information is a manual process as it is necessary to search through text files.
    - Comparison of data is difficult and often requires of lot of manipulations to copy the data in a tool that allows comparisons.
    - If the data is to be used in more than one CAD or CAE software, multiple files have to be maintained for the same materials. This is a typical source of data inconsistencies.
- Native database system of CAD/CAE software:
  - Benefits:
    - The main benefit of having materials information stored in CAD or CAE software is that there is no need for format the data before being able to use it.
  - Issues:
    - There is a lack of visibility over what is available to other teams or individuals.
    - Searching and comparing data is usually more difficult.
    - If the data is to be used in more than one CAD or CAE software, multiple libraries have to be maintained for the same materials.
    - It is difficult for non-CAD/CAE users (e.g., purchasing) to have input on the materials available for a new design.

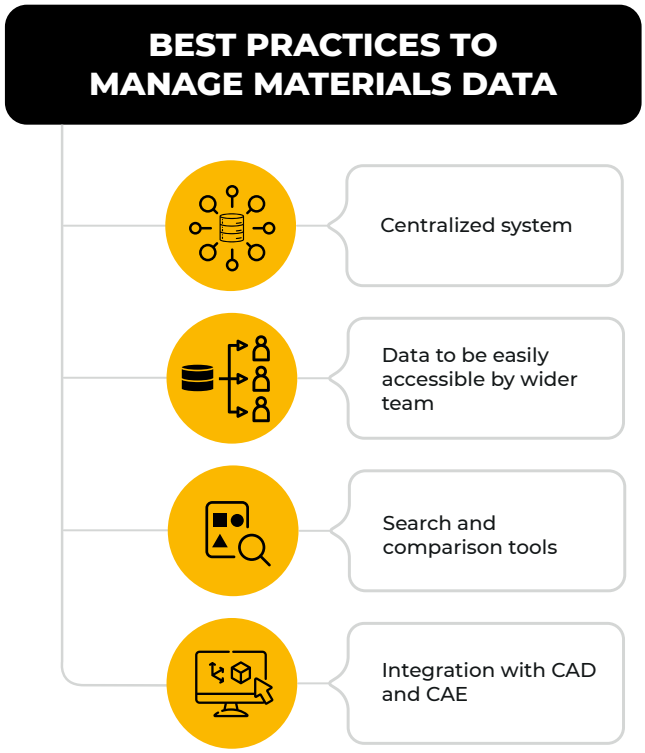
While these solutions enable companies to make progress and minimize some issues, they fail to fully answer the challenges of materials information. This is mainly because they were never designed as data management systems.

/ Answering the Challenges

As stated above, answering the challenges of materials information requires materials data to be accessible to everyone, comparable, integrated, controlled and maintainable. A centralized database with search and comparison tools, integrated with design and simulation software, and with appropriate maintenance tools will make this possible.

By centralizing all materials information in the same location, and by providing intuitive search and comparison tools, designers or simulation analysts in charge of choosing materials for the products can have a comprehensive view of all available information and make an informed decision. For example, a designer choosing a material based on density and Young's Modulus can easily check if the simulation team has advanced materials properties (e.g., fatigue curves) they will need later. They can also check whether this material is still approved for new designs by the purchasing department.

Also, by having a system integrated with their CAD and CAE software, the extra time previously required to copy information within the software and the associated risks of errors can be eliminated. Finally, with maintenance tools made available to key users only, materials information can securely evolve in the database to ensure that product development teams are always using the most up-to-date information.



Following Industry Best Practices

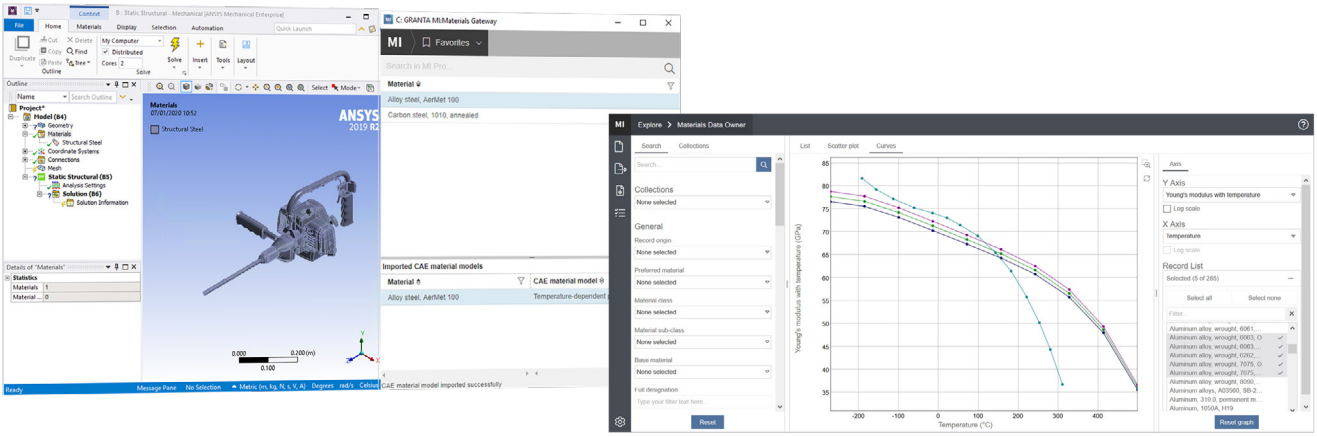


Figure 1. Comparison of materials using Ansys GRANTA MI Pro web application and assignment of materials in Workbench using the GRANTA MI Pro Workbench Gateway.

Ansys GRANTA MI Pro is a fast-start, cost-effective materials data management solution for design and simulation. It provides a database with simple tools to easily import and manage materials information. This database comes already preloaded with generic materials data provided by Ansys Granta, covering a wide range of materials classes, detailing physical, thermal and electromagnetic properties. It allows for the creation and control of a single source of approved materials, ensuring the data used across the organization retains full traceability to its source. Engineers can search and assign materials to their model in just a few clicks by accessing the database directly from their CAD/CAE systems using embedded apps. They can also use a web app to access more detailed property data, reviewing and comparing materials before the assignment. This ensures engineers assign the right material every time, leading to high-quality products.

Contact us and learn about Ansys GRANTA MI Pro

www.ansys.com/products/materials/granta-mi-pro

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