Leveraging a materials data management system to enable supply chain resilience

GLOBAL PRODUCT DATA

INTEROPERABILITY

SUMMIT 2025

BOEING ELYSIUM LOCKHEED MARTIN NORTHROP GRUMMAN Parker PDES, Inc.® Connecting the Digital Enterprise

Chris Franssen
Ansys Aerospace and Defense Platform Solutions

Presenters Bio

Chris Franssen – Ansys Platform Solutions for Aerospace and Defense
BS Systems Engineering from USNA and MS in Systems Analysis from NPS
Retired Naval Aviator, Life-long learner and technology enthusiast.
7 years in the electrical test and measurement industry
Joined Ansys New and Emerging Technology Team in 2020.
Focus on Digital Engineering solutions for Materials and Simulation
Participant in two applicable industry groups:

The Material Data Management Consortium (MDMC) is a unique collaborative project focused on developing and applying software to manage mission-critical materials data in sectors including aerospace, defense, and energy.

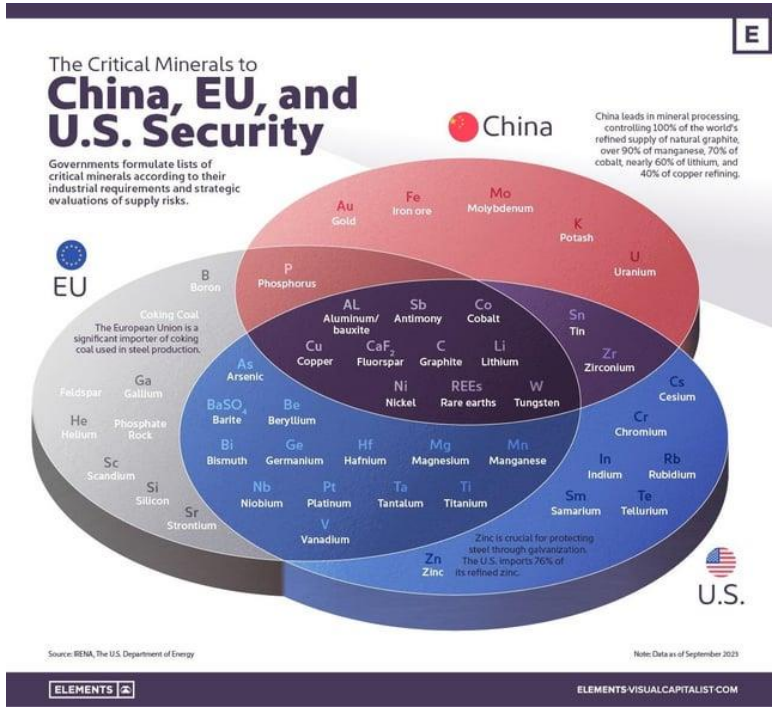
The Environmental Materials Information Technology(EMIT) Consortium develops and applies materials information technology solutions to assist design around environmental constraints, particularly those relating to restricted substances. These solutions are centered on information and decisions relating to materials and processes.

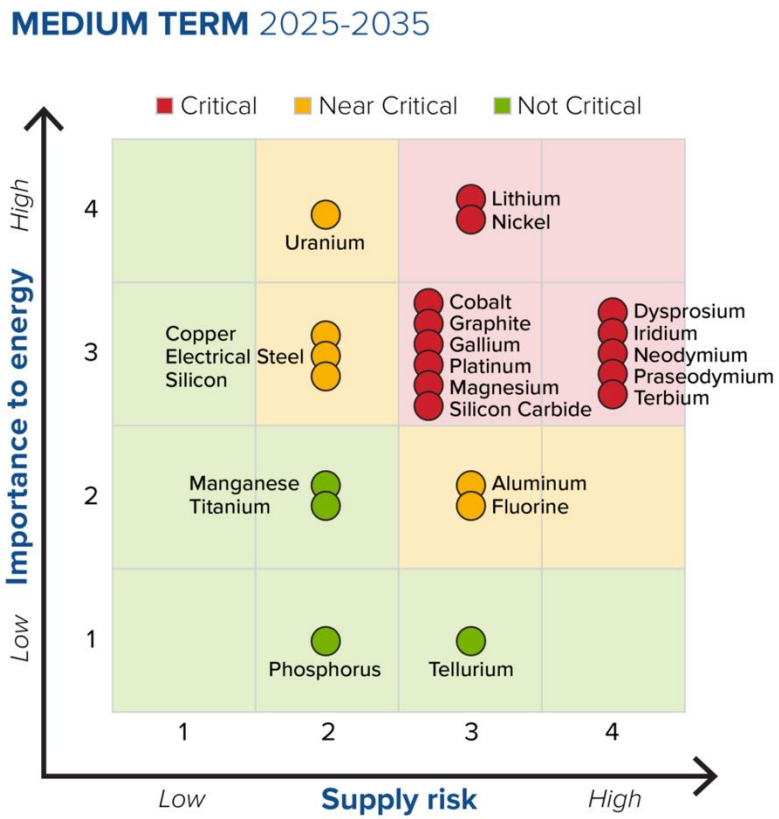
Some Numbers to Think about…

25	**25%**	**Global tariffs on steel and aluminum** being imported into the US. Outsized impact on automotive, aerospace, construction, energy industries.
295	**$295B**	**The trade deficit with China**, currently tariffs for all Chinese goods are 30%. Even with roll backs significant impact will be felt.
90	**90%**	China owns the global majority(90%) **of rare earth metal refining**, "The Middle East has its oil, China has rare earths" - DeDeng Xiaopingng
50	**50%**	In 2024, the U.S. relied on China for over 50% of its imports of some critical materials, such as yttrium, bismuth, antimony, arsenic, and rare earths, according to the USGS.
03302025	**May 30, 2025**	President Trump releases **“Immediate measure to increase American mineral production”** executive order
100	**100%**	China banned the export of gallium, germanium, antimony and other “super hard” materials crucial to produce semiconductors and other tech, to the U.S., in response to U.S. semiconductor export controls imposed by the Biden administration.

DOE Critical Material Assessment

Global Product Data Interoperability Summit | **2025**



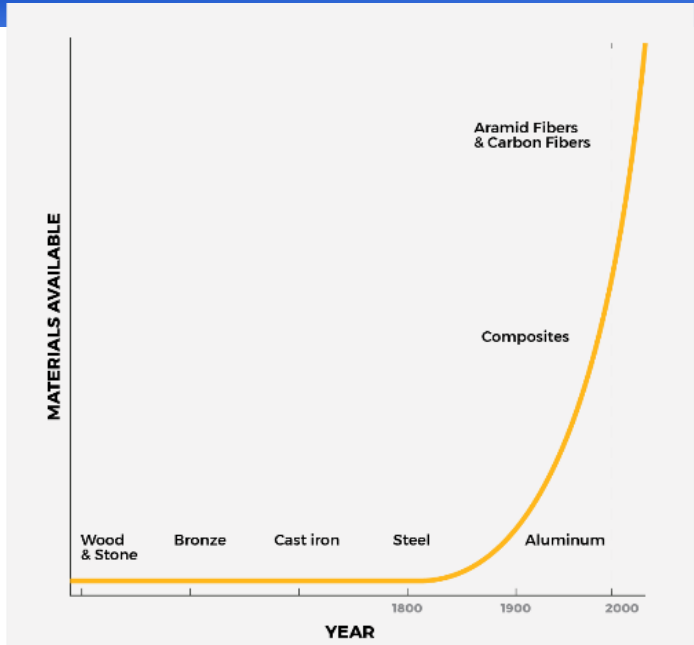


https://www.energy.gov/sites/default/files/2023-07/doe-critical-material-assessment_07312023

Table 5.1. Scoring metrics and thresholds for criticality assessment.

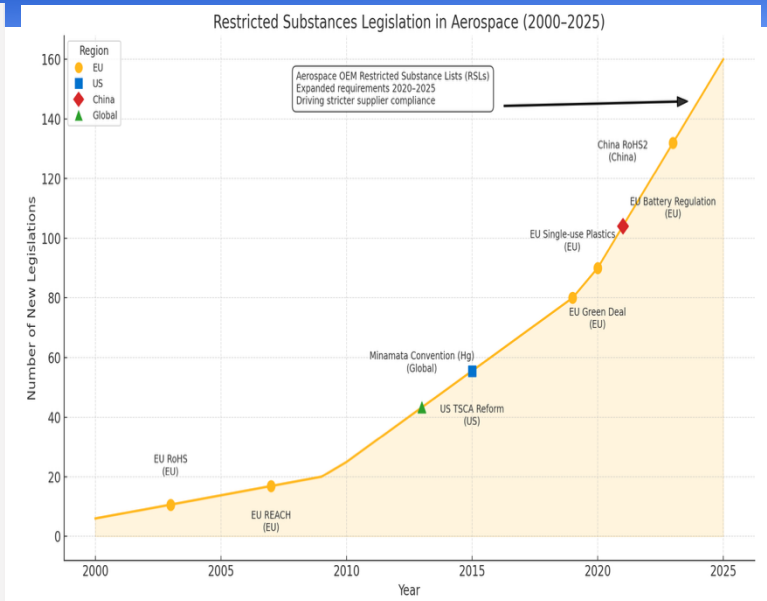
Factor	Metrics	Score = 1	Score = 2	Score = 3	Score = 4
Importance to Energy	Energy Demand (70%)	Meets one of the criteria below: (1) Market share of the material for energy applications <10%. (2) Market share of the most dominant specific sub-technology <10%.	Must meet both criteria below: (1) Market share of the material for energy applications ≥10%. (2) Market share of the most dominant specific sub-technology ≥10%.	Must meet both criteria below: (1) Market share of the material for energy applications ≥40%. (2) Market share of the most dominant specific sub-technology ≥25%.	Must meet both criteria below: (1) Market share of the material for energy applications ≥ 70%. (2) Market share of the most dominant specific sub-technology ≥50%.
	Substitutability Limitations (30%)	**Perfect or near-perfect** substitutes are available at material and system levels with **little to no limitations or concerns.**	Substitutes are available at either material or system levels with **minor limitations or concerns.**	Substitutes are available either at the material level or systems level with **major limitations or concerns.**	**No substitutes** are available at either the material or system levels.
Supply Risk	Basic Availability (40%)	**No concerns** about existing capacity to meet near- and medium-term demand.	**Minor concerns** about capacity to meet near- and medium-term demand.	**Major concerns** about capacity to meet near- and medium-term demand.	**Grave concerns** about capacity to meet near- and medium-term demand.
	Competing Technology Demand (10%)	CAGR of any non-energy application ≤ 3%.	CAGR of any non-energy application ≤ 5%.	CAGR of any non-energy application ≤ 10%.	CAGR of any non-energy application >10%.
	Political, Regulatory, and Social Factors (20%)	Weighted average percentile of Governance Indicators and Environmental Performance Index is greater than 60.	Weighted average percentile of Governance Indicators and Environmental Performance Index is from 45 to 60.	Weighted average percentile of Governance Indicators and Environmental Performance Index is from 30 to 45.	Weighted average percentile of Governance Indicators and Environmental Performance Index is less than 30.
	Co-depend-ence on Other Markets (10%)	Must meet both criteria below: (1) May or may not be produced as a co-product of other metals. (2) **Produced** as a main product in **most circumstances.**	Must meet both criteria below: (1) Most (>50%) production is as a co-product or as a by-product of other metals. (2) **Produced** as a main product in **some circumstances** OR there is excess by-product supply in the market.	Must meet both criteria below: (1) Significant (>75%) production as a co-product or by-product of other metals. (2) **May be produced** as a main product in **some circumstances** AND there is not excess by-product supply in the market.	Must meet both criteria below: (1) 100% of production is as a co-product or as a by-product of other metals. (2) **Not produced** as a main product anywhere in the world AND there is no excess by-product supply in the market.
	Producer Diversity (20%)	Herfindahl-Hirschman Index (HHI) less than 2500	HHI from 2500 to 3332	HHI from 3333 to 4999	HHI greater than or equal to 5000

The Materials Compliance Challenge



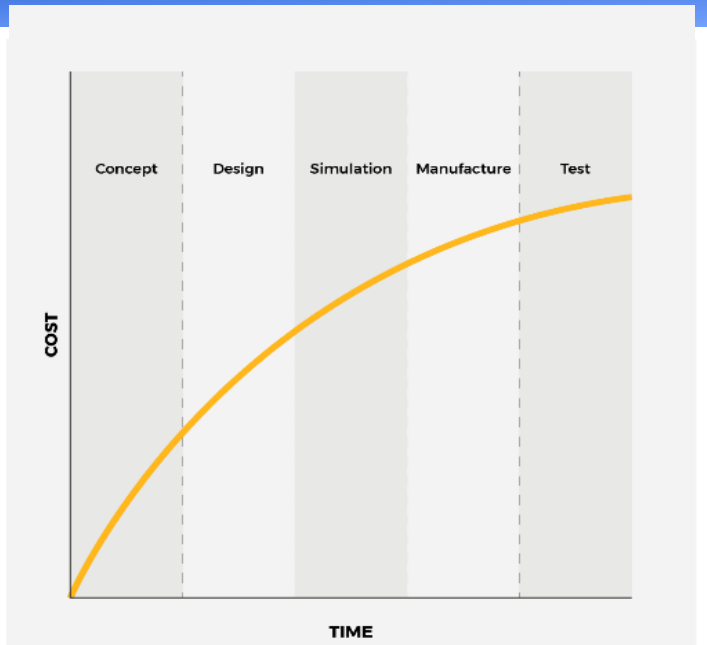
MATERIAL CHOICES ARE INCREASING DRAMATICALLY

- Materials information is complex
- Difficult to acquire information from supplier chain



CONTINUOUS INCREASE IN RESTRICTED SUBSTANCES

- Legislation change on a regular basis
- Requirements differs by geography



THE COST OF CHANGING MATERIALS RISES OVER TIME

- Product lifecycles can be long
- The problem is distributed across teams

Mitigate Risk via Supply Chain Resilience and Materials Data management

Supply Chain

- Increased Costs
- Manufacturing Delays
- Onshoring & Nearshoring

Regulations & Market

- Regulatory Complexity
- Tariffs & Trade Policy
- Compliance Issues

Workforce

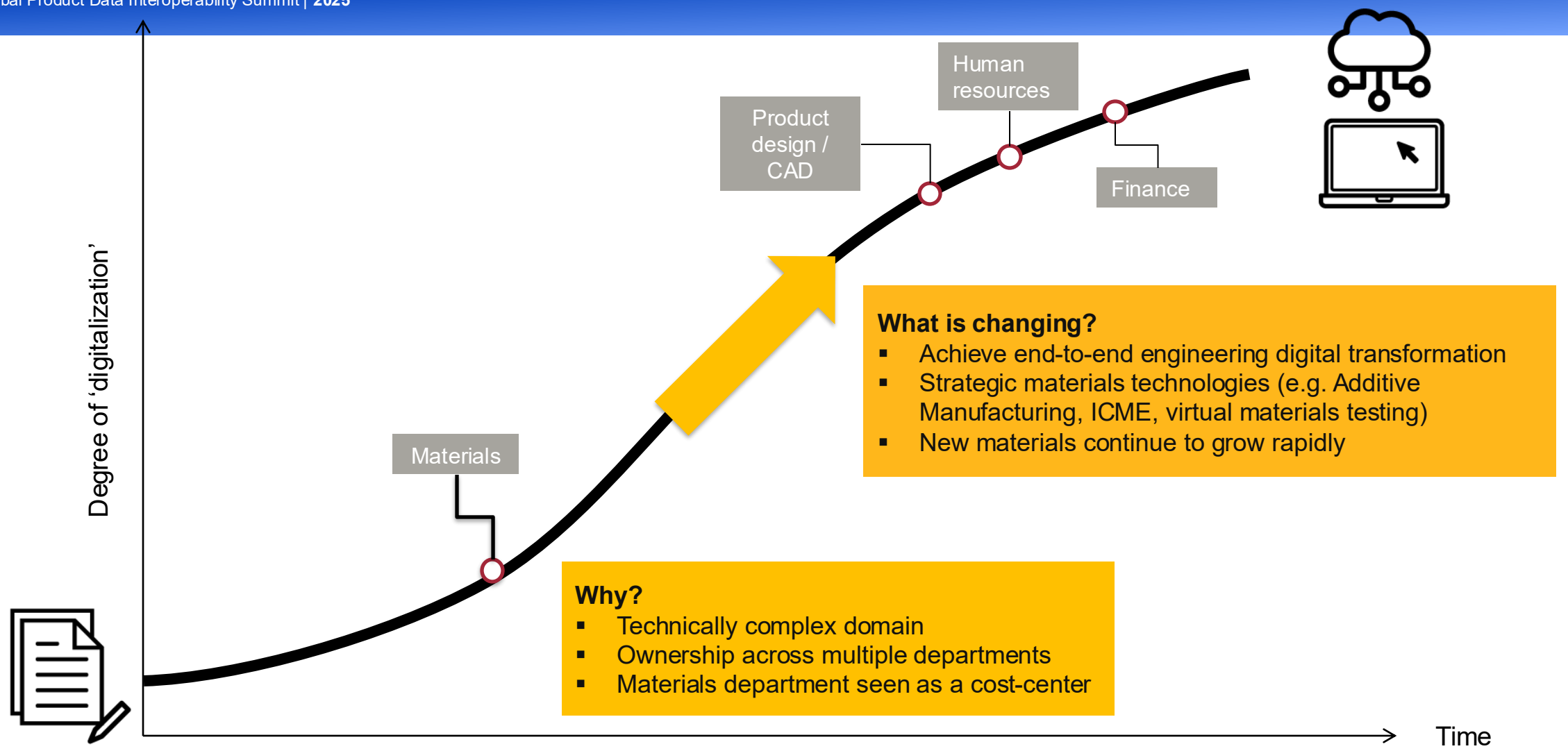
- Layoffs & Labor Shortages
- Hiring freezes
- Engineering Knowledge Gaps

***ACCELERATE** DESIGN DECISIONS & TIME-TO-MARKET BEATING COMPETITORS*

***REDUCE RISK** BY ENSURING COMPLIANCE & TRACEABILITY ACROSS YOUR LIFECYCLE*

***OPTIMIZING** WORKFORCE EFFICIENCY AND **AUTOMATING** WORKFLOWS*

Materials is the next step for digital transformation



What is changing?

- Achieve end-to-end engineering digital transformation
- Strategic materials technologies (e.g. Additive Manufacturing, ICME, virtual materials testing)
- New materials continue to grow rapidly

Why?

- Technically complex domain
- Ownership across multiple departments
- Materials department seen as a cost-center

What is the high-level challenge & context?

How can leaders build resilience to changing tariffs?

- *Assess comprehensive supply chain vulnerability.* This analysis should go beyond the surface level to understand first-, second-, and third-tier suppliers' exposure to potential tariffs and retaliatory tariffs. Firms can examine the complexity and geography of each step in their manufacturing process—mapping goods' countries of origin and total landed costs
- *Explore alternate supply sources.* Mapping out supply chains and assessing the feasibility and costs of switching suppliers can help inform leaders' decisions on tariff responses.
- *Validate shifts in strategy.* Tariff policy is difficult to predict, and shifts may be temporary. Hence, any strategy shifts made in response to tariffs should be grounded in rigorous analysis that supports long-term value potential and that can hold up to further shifts in trade policy.

https://www.mckinsey.com/capabilities/geopolitics/our-insights/tariffs-on-the-move-a-guide-for-ceos-for-2025-and-beyond

What does all 3 of them have in common?

Understanding in detail Materials & Processes used in making the physical products!

What is the high-level challenge & context?

Exhibit 2

Five management practices distinguish leading growth transformers from peers.

Difference in practice ranking, leading growth transformers vs other growth transformers,[1] ranking delta

[1]Rank difference is the delta between the relative importance/emphasis of a practice from a leading growth transformer vs other growth transformer. The max score is 42. Leading growth transformer is defined as an organization that is growing profitably above peers, 2017–22. 2 criteria need to be met to be categorized as a growth outperformer: above-median revenue CAGR vs subsector peers and above-industry median profitability (ie, economic profit/revenues) vs subsector peers.
[2]Organizational Health Index 4.0 practice(s) leading growth transformers uniquely emphasize, meaning the practice is in the top 12 of the practice rank for leading growth transformers and at least +12 rank difference from other growth transformers.
Source: 2023 Organizational Health Index database; leading growth transformer (n = 15), other growth transformer (n = 31)

Next-normal supply chains are significantly more complex.

Traditional supply chain strategy areas of focus

Next-normal strategy with new areas of focus

McKinsey & Company

As-Is

Product Engineering team designs a Product, and procurement/supply-chain finds the cost-effective route that meets quality & delivery timeline.

To-Be

Product Engineering team is provided with detailed data-driven insights of various factors in the Supply-Chain to help them make right Materials & Process choices.

Unlocking the Full Potential of your Materials Information

Authoritative Source of Truth for the Enterprise

Transform materials data into a **strategic asset** with a centralized "gold source," eliminating inconsistencies and enabling **confident engineering decisions**

Seamless Tool Integration

Access materials data directly within **CAD, PLM and simulation environments** through an **open ecosystem** with integrations to all major engineering tools.

High Quality Material Properties

Access an **extensive materials library** with simulation-ready properties, sustainability metrics, and compliance information for any engineering challenge.

Reduce Business Risk

Ensure **regulatory compliance**, enable consistent simulation results, and preserve **materials IP**—reducing costly recalls and warranty claims.

Smarter Materials Selection

Find **optimal materials in minutes** using unique graphical tools and comprehensive property data—reducing prototyping costs by up to 50%.

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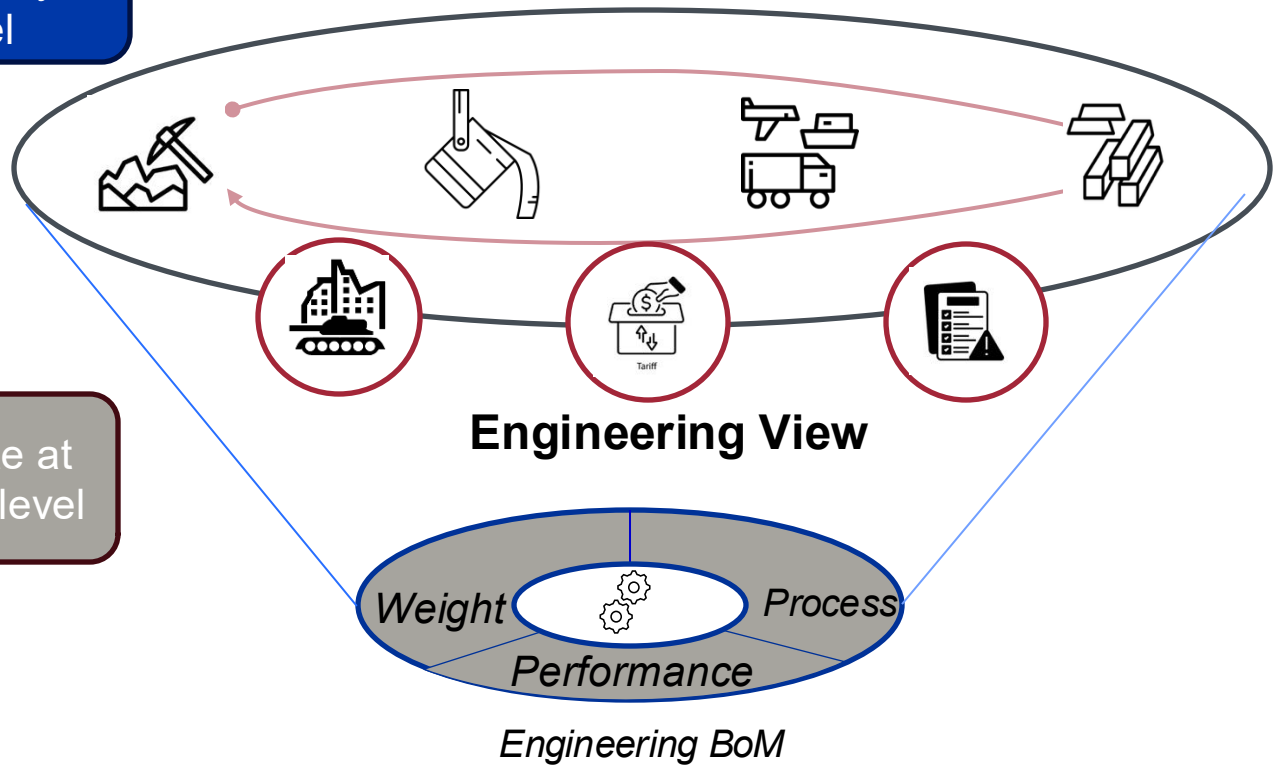
Connect Corporate Decision Making with Engineering Expertise

Evaluate at company level

Supply Department

Evaluate at product level

Designer, Engineer, SME



Strategies for materials

- Authoritative Source of Truth for Materials Data
- Create Company Preferred Materials List

Enables
Reduction of risk, cost, and delays

- Use Materials ASoT for consistent data
- Leverage readily available quality data for comparison

Enables
Informed Material Selection and increased performance

Need to implement all strategies

Material Intelligence for Sustainable Design & Engineering

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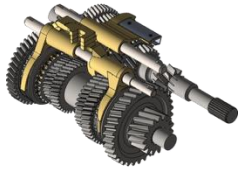
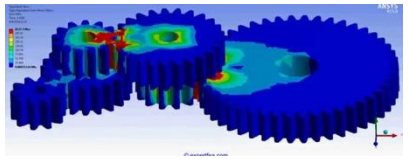
Concept & Design | **Preliminary Design** | **Detailed Design & Optimization** | **Prototype & Test** | **Production & Launch**





Reference Data

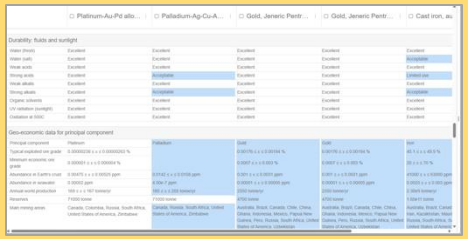
Integrate with CAD, PLM, Simulation…

All engineering materials → *Alloy A, Alloy B, Polymer A* → *Alloy B Type 1, Alloy B Type 2, Alloy B Type 3* → *Alloy B Type 2* → *Alloy B Type 2 approved*

Materials Information Management

Materials Selection

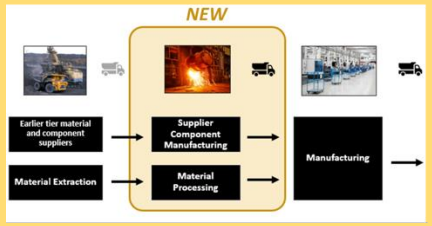
Trade-off / Cost / Structural / Environmental / Thermal



Optimal Material Candidate selection from Approved materials List, Reference Data, Supplier Data Sheets or Internal Data

Supply Chain Assessment

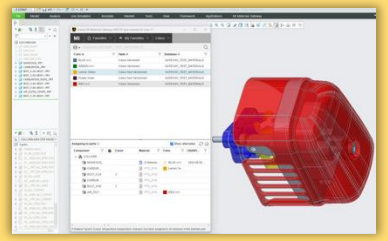
Strategy / Risks / Reuse / Recycle



Material Availability
Specify transport & location on parts and sub-assemblies

Testing & Simulation

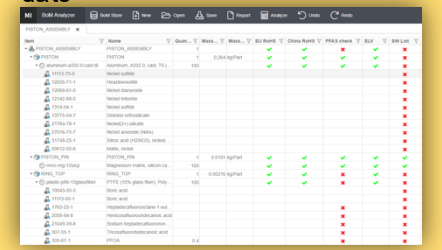
Deformation / Durability Toughness



Materials Properties formatted to suppot Simulation and Analysis

Compliance

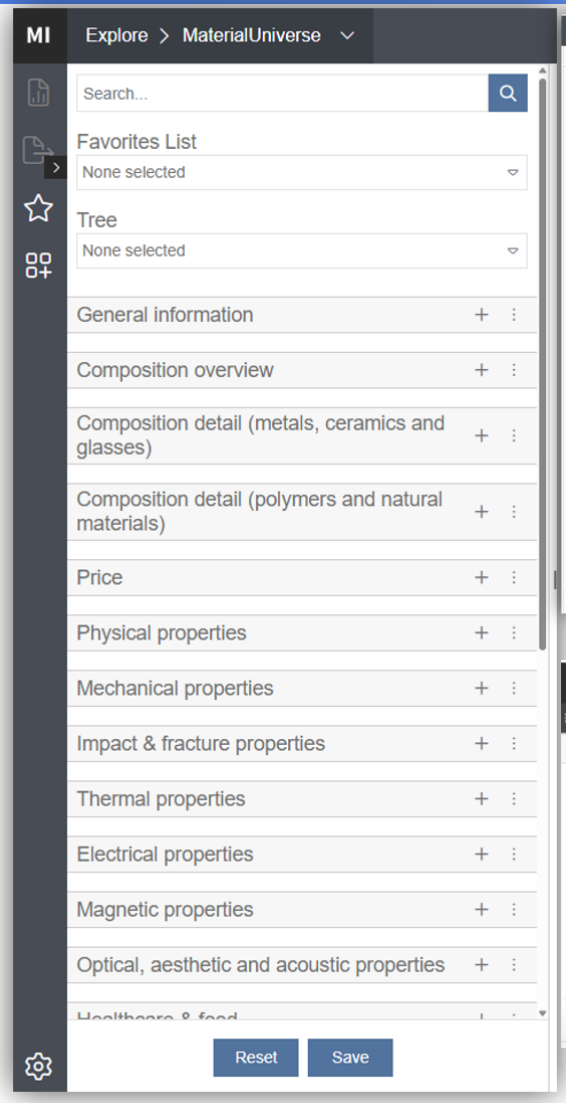
Check / Substance / SDS / Up-to-date

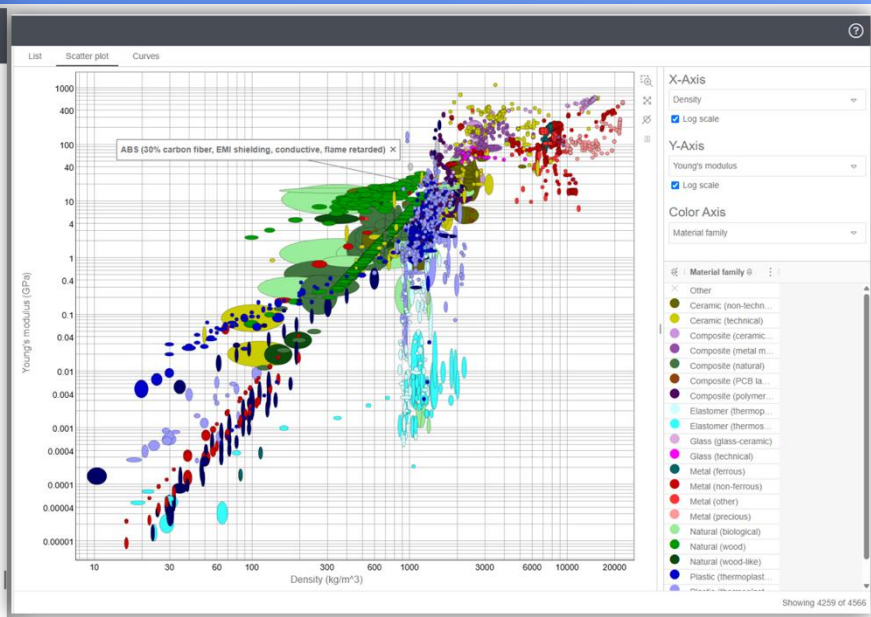


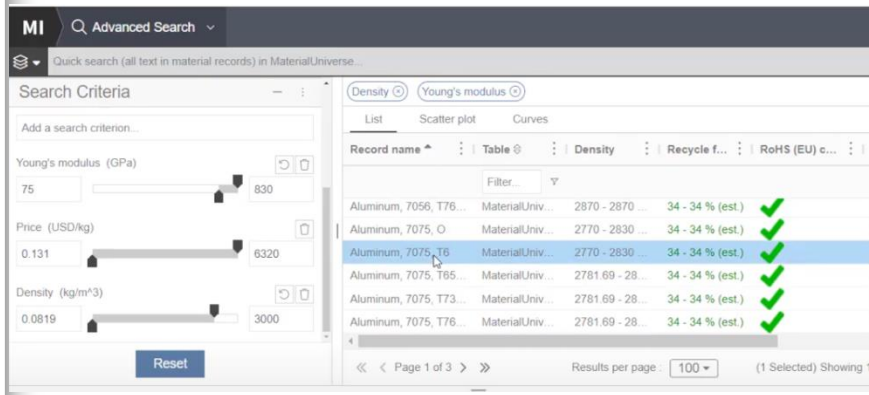
Regulation updates: REACH, RohS, Critial Materials, PFAS, TSCA, ….

Material Data at part of early conceptual design

- **Leverage preferred materials lists based on existing supply chain**
- **Select the best materials based on technical requirements**
- **Identify new materials and address any in-house data gaps**
- **Understand price impacts and potential regulatory impacts from material selection**
- **Carry out “what-if?” studies to see the impact of changing materials**







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Granta MI for Supply Chain Resilience

Product Engineering Team

SIMULATION

PRODUCT DESIGN & DEVELOPMENT

MANUFACTURING

Supply Chain

PROCUREMENT

SUPPLIERS

"This Part needs to be made using **Titanium, alpha-beta alloy, Ti-6Al-4V** aged (let's call it Mat A), billet thickness of 50mm"

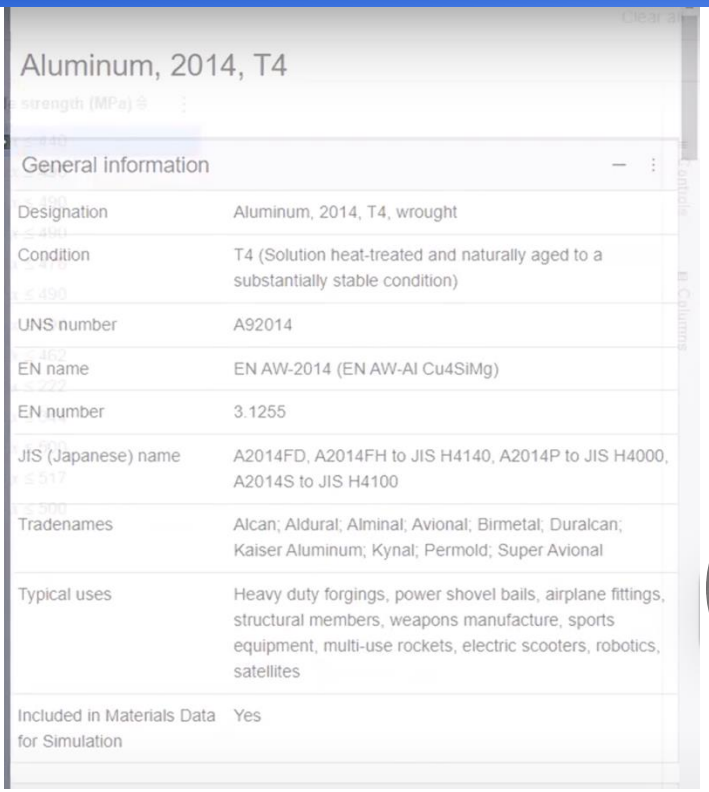
However, the following material could also be an alternative but no one other than the PE team will know this;

1. Titanium, alpha-beta alloy, Ti-6Al-4V annealed (Mat B)
2. Titanium, alpha-beta alloy, Ti-6Al-4V ELI annealed (Mat C)

"We can source Mat A only from Country A & B and we need to send it to Supplier <1> for final processing, we need to qualify the Supplier <1>"

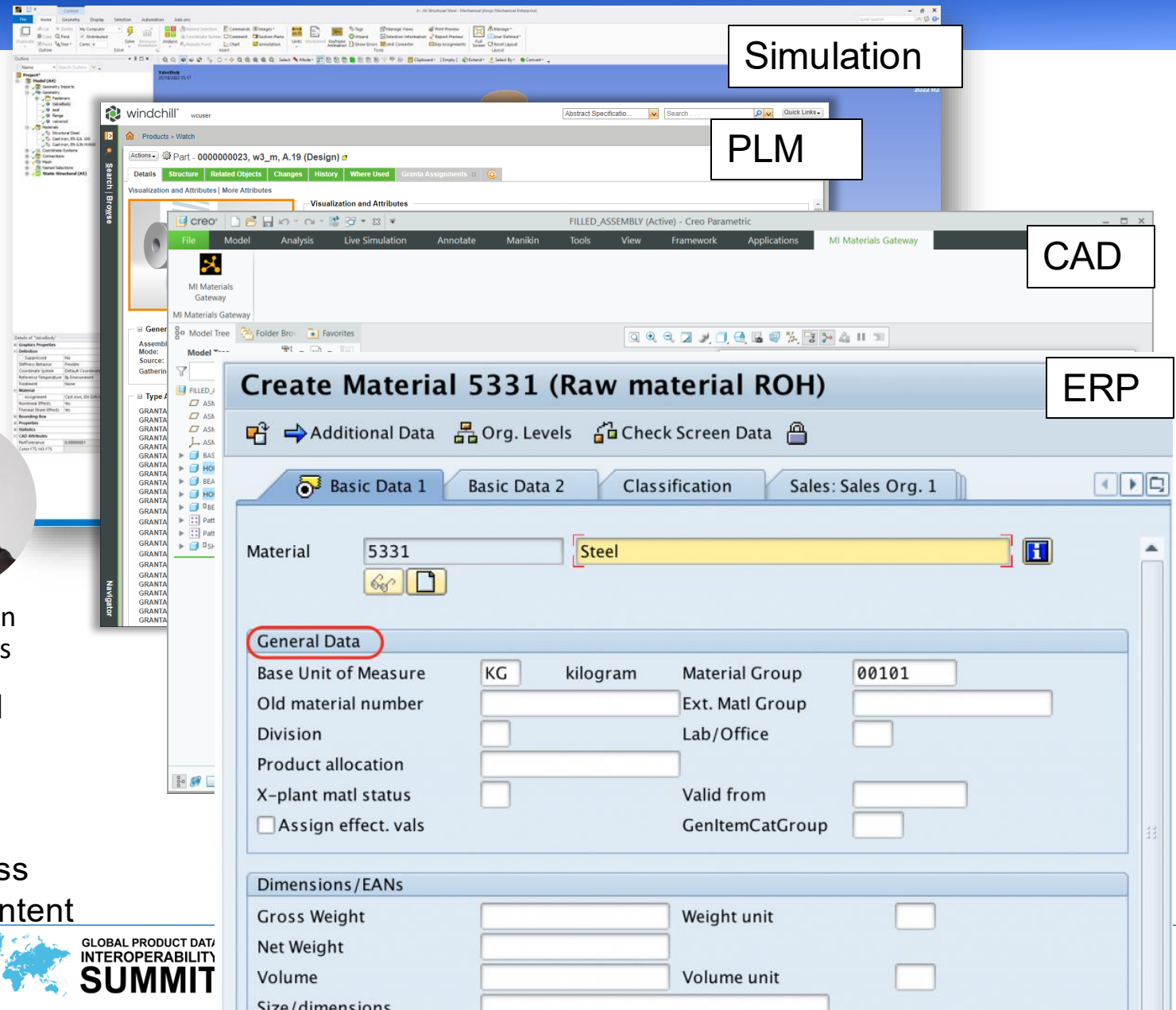
However for Mat B & C the Supply Chain team has wider options and overall it costs less for the company.

Integrate with CAD, PLM, Simulation, ERP etc.



CAD Engineers

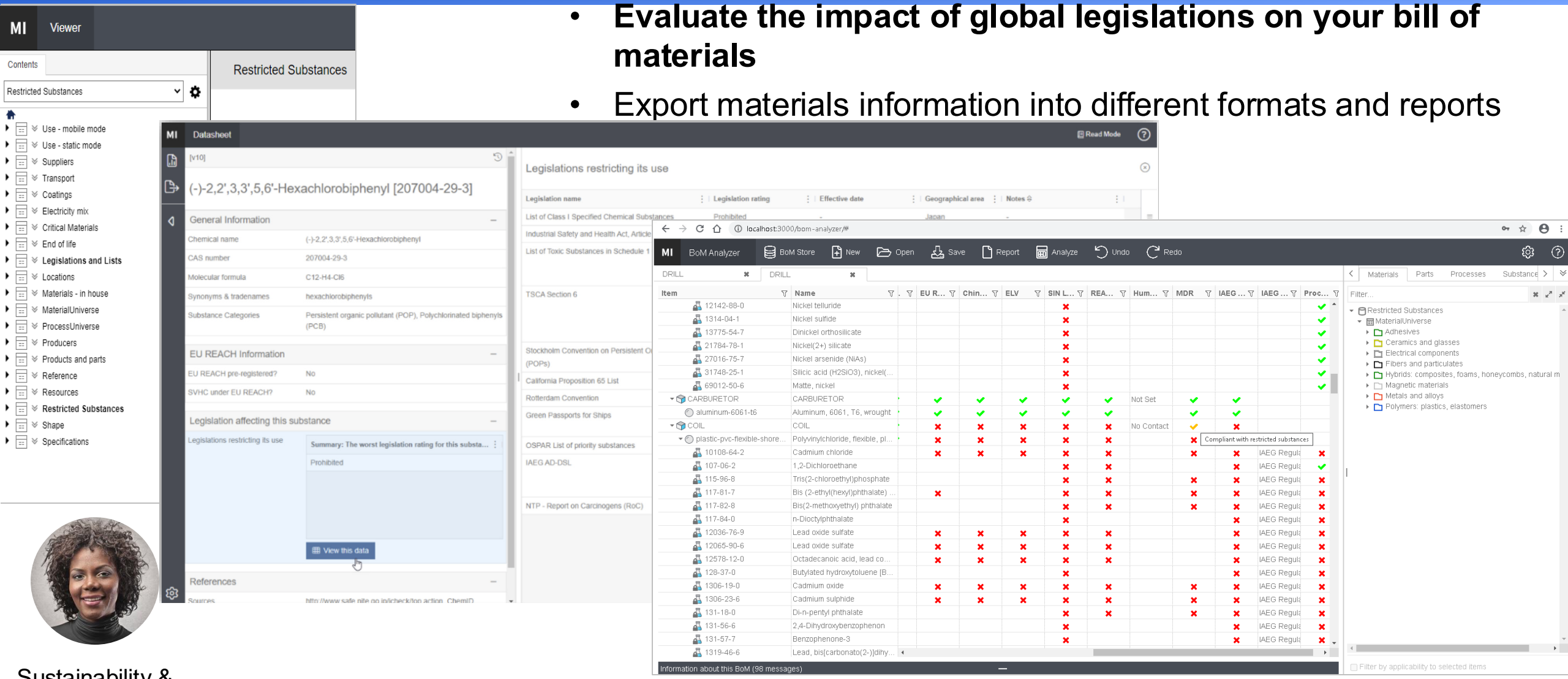
Simulation Engineers



- **Access all materials directly in native CAD/PLM tools**
- Publish preferred materials and processes
- Flag sustainability metrics directly in design tools
- Transfers BoMs directly into BoM Analyzer to assess environmental footprint or restricted substances content

Compliance with Legislation & Reporting

- **Evaluate the impact of global legislations on your bill of materials**
- Export materials information into different formats and reports



Sustainability & Compliance Engineers

Informed Materials Decisions throughout

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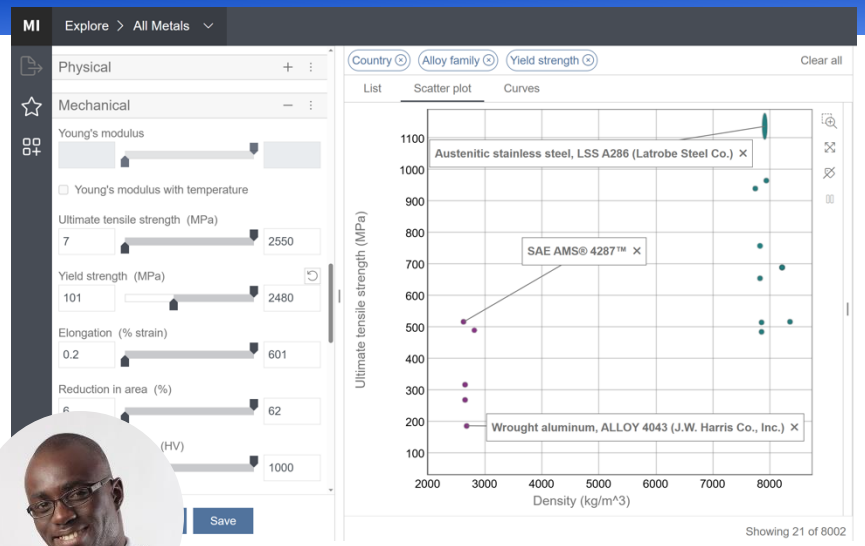
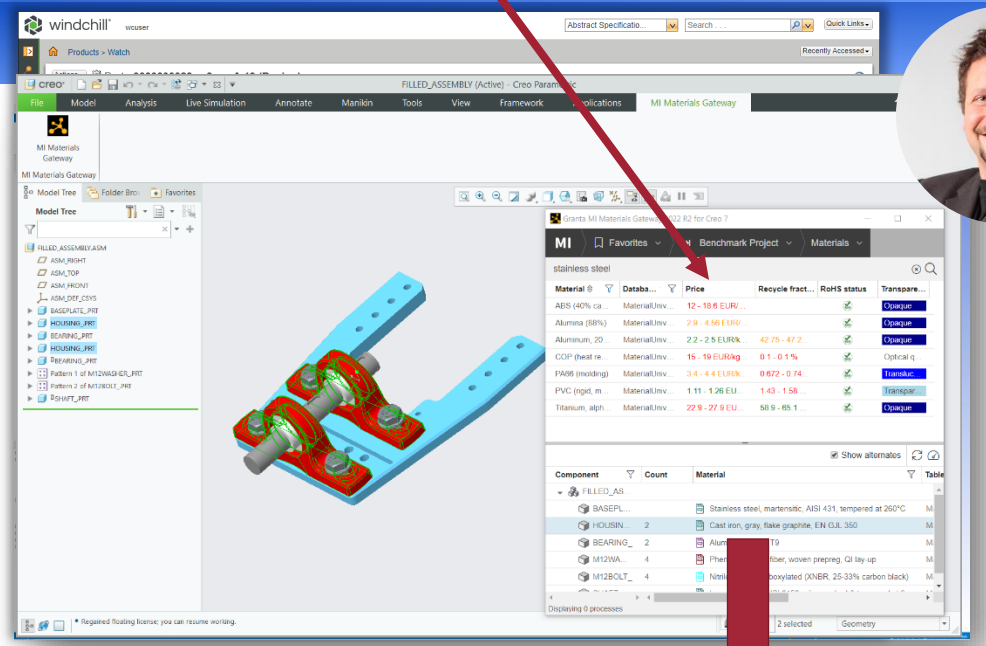


Materials Experts

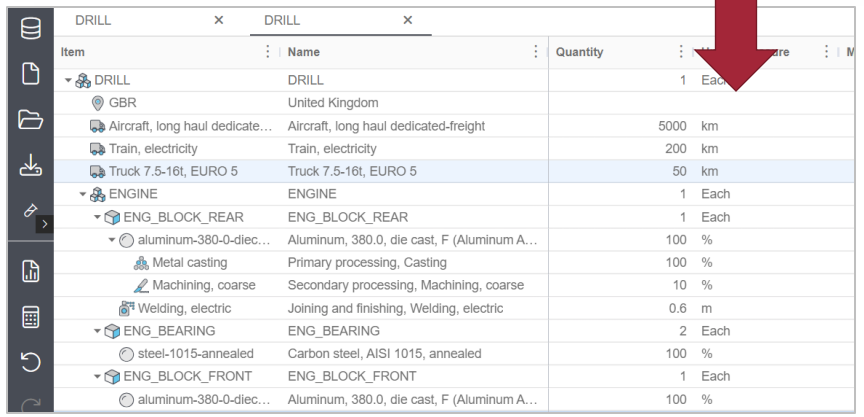
Trade-off technical, economic & **availability** requirements

Publish updated preferred materials lists

Cost and Availability metrics flagged in UI



CAD & Simulation Engineers



Analyse & compare multiple designs

Procurement/ Compliance

- **Access all materials directly in native design and engineering tools**
- Publish preferred materials and processes
- Flag cost and availability metrics directly in design tools
- Answer ‘where used’ queries on product, part and component level

Informed Materials Decisions throughout

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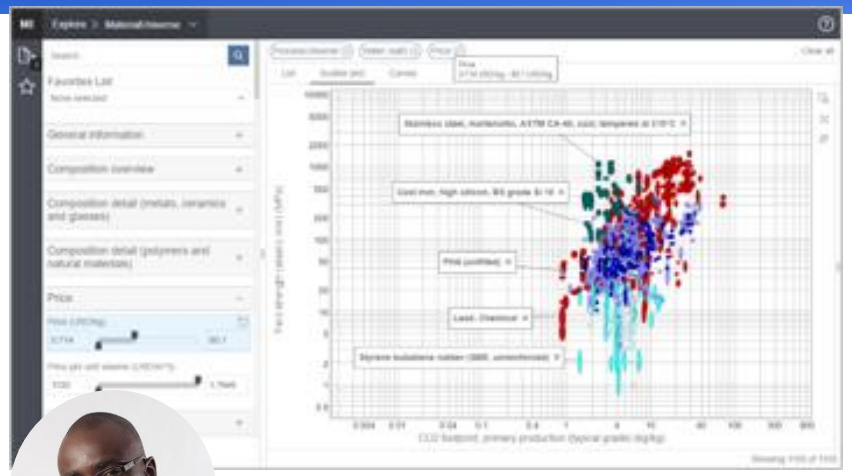
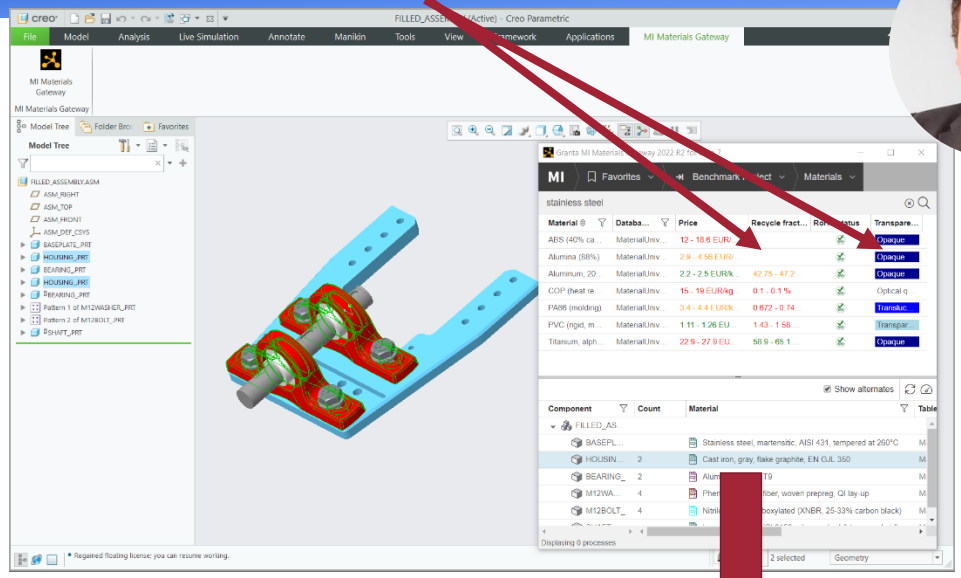


Materials Experts

Trade-off technical, economic & **risk** factors

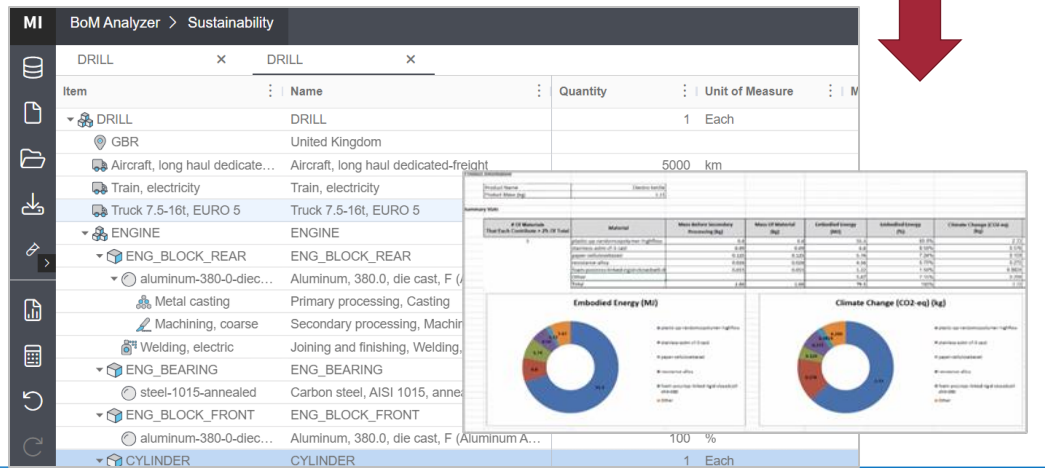
Publish updated preferred materials lists

Risk/impact metrics flagged in UI



CAD & Simulation Engineers

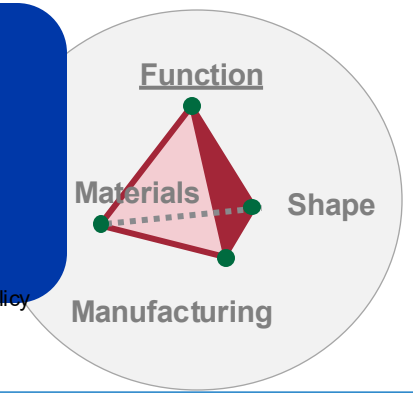
Run analysis on BoM



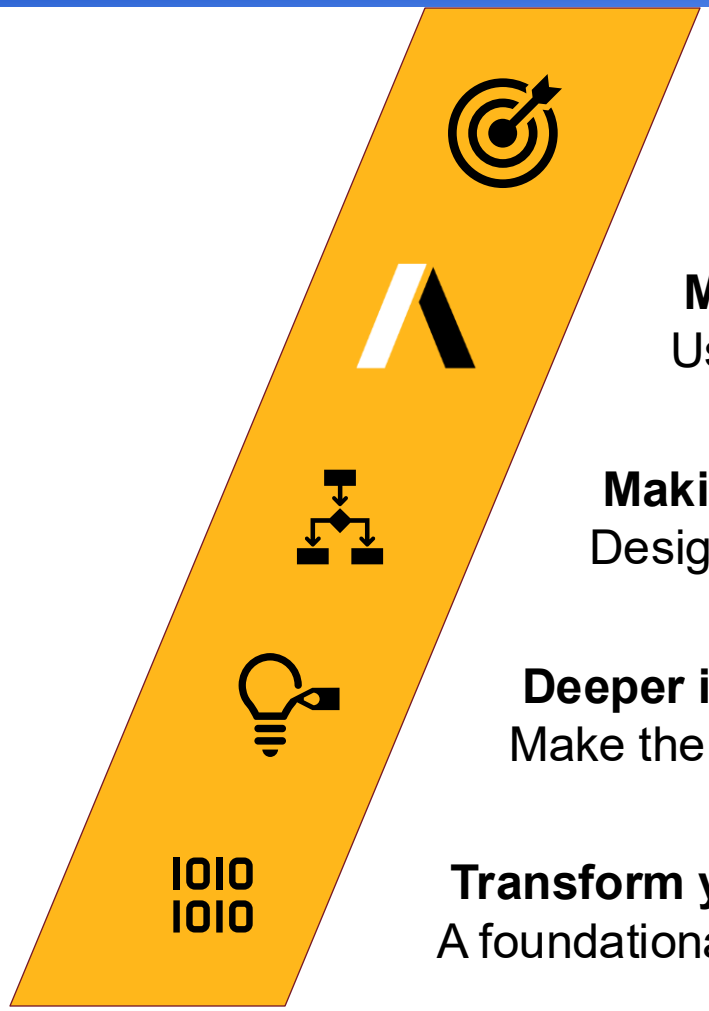
Report & compare multiple designs

"It is estimated that **over 80% of all product-related impacts** are determined during the concept & design phase of a product"*

*https://ec.europa.eu/jrc/en/research-topic/sustainable-product-policy



Benefits of transforming your materials information



Accurate materials information. Accurate results.
Leverage comprehensive and trusted materials information

Making Engineering easier with an Open Ecosystem.
Use across CAD, CAE and PLM – integrated into the product development process

Making engineering teams more productive
Design, Materials or Simulation teams share consistent and traceable data

Deeper insights into your products
Make the right trade-offs to reduce risk and improve quality. Make better products.

Transform your business
A foundational step to a wider engineering digital transformation

Material Intelligence for Sustainability

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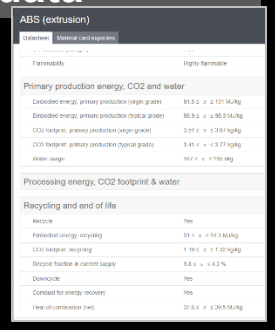
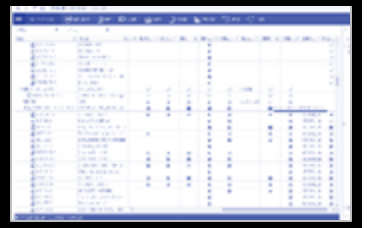
Reference data

Comprehensive, trusted material property data for materials properties, economic factors, critical materials risk, regulation, and sustainability…



Compliance with Legislation

De-risk your BoM by evaluating Restricted substances and regulations impact on your product



Integrate with CAD, PLM, Simulation

Engineers can access materials directly within native CAD, PLM and Simulation tools, for informed design decisions.

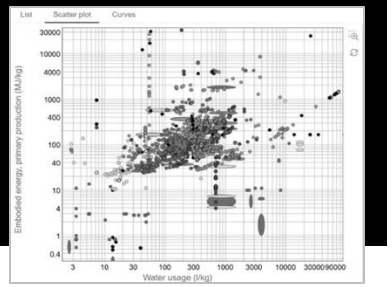
DATA SELECTION

Granta MI

INFORMATION MANAGEMENT

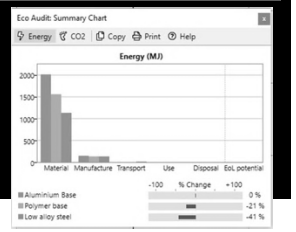
Compare material properties

Use best-in-class selection tools, like the Ashby plot, to down-select on the best material for your application.



Early impact assessment

Explore the impact of a material across the life cycle, early in design, not when it's too late.



Authoritative source of truth

Offer a traceable, authoritative source for materials across every team – from design, simulation to sustainability teams.

Observed Supply Chain resiliency benefits from a Materials Information System

Before:	**With Granta MI:**
11 people took	1 person took
14 hours, found	20 minutes, found
2 impacted materials	6 impacted materials

"By managing and linking together all relevant data, we enable better answers in much less time"

"Ansys Granta solution has become 'invaluable' to our RS process"

- Project Engineer, Chemical and Material Risk Management, Major Aerospace OEM

Substitute Materials Substitution Days » Seconds

"The Granta system has given me the capability to multi-task. The system allows me to make substitutions on the fly, something that would have taken me a couple of days now can take me a few seconds."

-Medical device manufacturer

10X savings in time

"Reduced time spent looking for materials information from 30+ min/week to 3 minutes/week.

-Major Aerospace OEM

Reduced selection time and cut cost in 2 projects:

- Redesign of a pressure regulator housing
- Replacing an Aluminium ATS oil cover with a polymer composite

"An essential tool for preliminary design, component re-design, material obsolescence issues, and proposals."

-Major Aerospace Company

Questions?

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