



# Using Ansys Granta Selector to Help Resolve Materials Shortages

As of May 2021, raw material prices, from steel to plastics, have surged due to growing market demand as economies ramp back up post-pandemic. This follows worldwide shutdowns in early 2021 of raw material processing plants because of the COVID-19 pandemic's impact on demand and various country-specific lockdowns. Supply chain shocks are also strongly affecting prices — from irregular winter weather impacting plastics production to container ships blocking the Suez Canal.

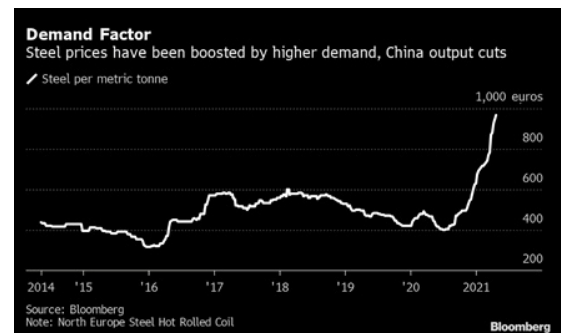
## / THE CHALLENGE

This surge in demand for various raw materials and chemicals and has put strain on some supply chains, and according to a recent survey by the Institute of Supply Management, is anticipated to get worse. They anticipate that disruptions could last for longer than 12 months .

When dealing with a world-wide supply shortage or increase in prices, an alternative suitable raw material must be found. But, when seeking an alternative, the necessary material properties (which are application-dependent) must be maintained or even improved upon.

Trading-off performance requirements such as cost , supplier availability and sustainability, among many other factors, leads to the selection of true alternative materials. The sooner this can be done in the product development process, the lower the cost of change to the overall design.

Ansys has the right tool for engineers facing this dilemma: Ansys Granta Selector.



Raw material prices are steadily increasing

**/ MATERIALS EXPERT**

- Alternative to this polymer?
- Minimal cost increase
- Can it be sourced?

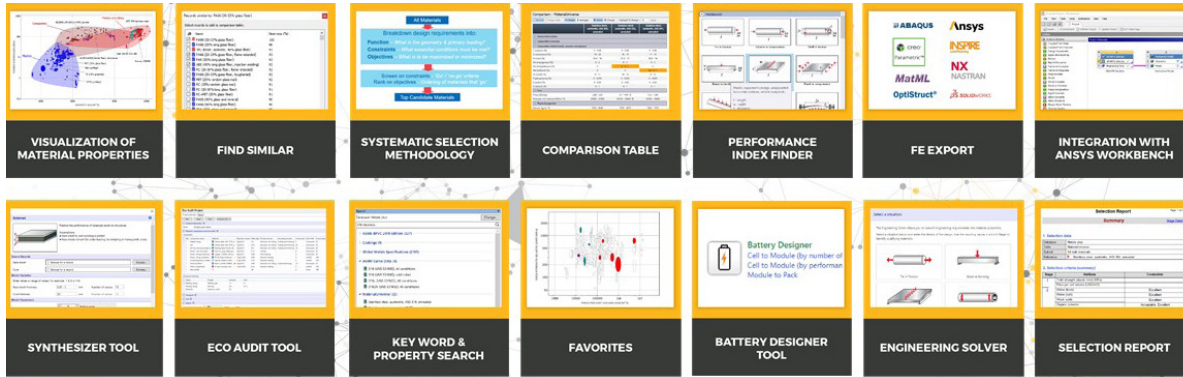
**Ansys / GRANTA SELECTOR**

- Which polymer?
- Where to find data?
- Can it be sourced?

**/ SIMULATION ENGINEER**

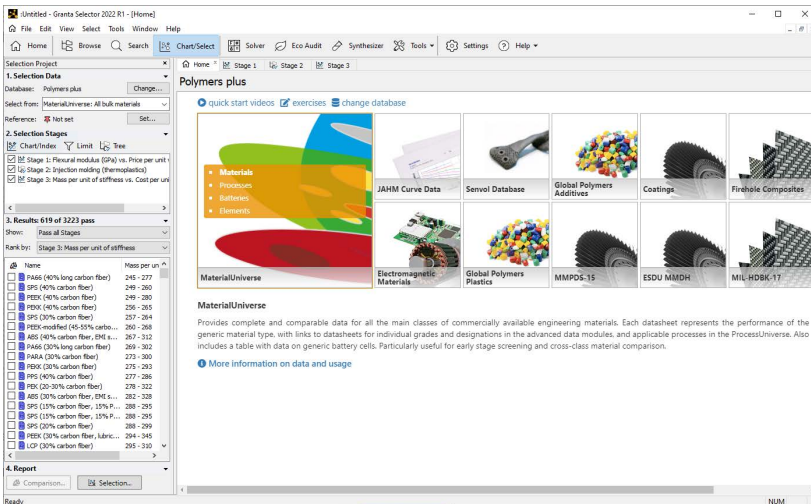
# / SOLUTION

Granta Selector enables engineers to make the right material decisions based on a series of sophisticated tools combined with access to an unrivalled materials data library. Key tools include visualization and comparison of materials properties, performance indices, export of key materials data for simulation or use in CAE/CAD programs and many more. Engineers have the right tools and data to make an informed decision, and can even assess the environmental impact of their products or predicted properties of new hybrid materials.



Ansys Granta Selector - Advanced selection tools

Granta Selector's interface enables quick access to relevant materials classes and datasets.



Ansys Granta Selector - primary user interface

If there is a shortage of a particular material, an engineer might look for an alternative. Let's consider a case in which there is a shortage of PA66 with 30% glass fiber. We can search for this material and view its MaterialUniverse™ datasheet, then set it as a reference for comparison.

**PA66 (30-33% glass fiber)**

Polymers: plastics, elastomers > Plastics > Thermoplastics > PA > Polyamide/Nylon > PA66 > Glass filled >

**General information**

**Overview**

Note: Polyamides are moisture sensitive. Density, mechanical, impact, and electrical properties on this datasheet are for material conditioned at 50% relative humidity and 23°C. These are more typical of in-use performance than the properties of the dry material. Other properties are for the dry-as-molded material.

**Designation**

Polyamide (Nylon) (Type 66, 30-33% Glass Fiber)

**Trademarks**

Akronox, Akulon, Alamid, Altech, Amilan, Anjakom, Anjakom, Aphenix, Badamid, Bergamid, Bestrol, Cebran, Chemion, Compamid, Domamid, Durethan, Eparamid, Geramid, Orion, Kapamid, Kopa, LMP Thermocoo.

**Composition detail (polymers and natural materials)**

Polymer	87	-	70	%
Glass (fiber)	30	-	33	%

**Price**

Price	2.94	-	3.46	GBP/kg
Price per unit volume	3.96e3	-	4.77e3	GBP/m <sup>3</sup>

**Physical properties**

Density	1.35e3	-	1.38e3	kg/m <sup>3</sup>
---------	--------	---	--------	-------------------

**Mechanical properties**

Young's modulus	6.11	-	7.62	GPa
Specific stiffness	4.47	-	5.59	MN/m <sup>2</sup> /kg
Yield strength (elastic limit)	138	-	140	MPa
Tensile strength	142	-	156	MPa
Specific strength	101	-	103	kN/m <sup>2</sup> /kg
Elongation	4.73	-	5.5	% strain

Set as reference

**Restricted substances risk indicators**

RoHS (EU) compliant grades?  0.02

REACH candidate List indicator (0-1, 1 = high risk)  0.02

Note: Most common restricted (per): Substances / Pigment up to 0.1%, UV stabilizer up to 1.4%.

SIN List indicator (0-1, 1 = high risk)  0.02

Note: Most common restricted (per): Substances / Pigment up to 0.1%, UV stabilizer up to 1.4%.

**Absorption & permeability**

Water absorption @ 24 hrs	0.51	-	0.83	%
Water absorption @ sat	5	-	6.6	%
Humidity absorption @ sat	1.4	-	1.9	%

**Chemical resistance of polymers**

Chemical resistance, data sources

Derived from Rapra ChemRes record for Polyamide 66 (33% glass fibre reinforced)

Acetaldehyde	0	-	Limited	
Acetic acid (10%)	0	-	Limited	
Acetic acid (glacial)	0	-	Limited	
Acetic anhydride	0	-	Limited	
Acetone	0	-	Satisfactory	
Acrylonitrile	0	-	Satisfactory	

**Primary production energy, CO2 and water**

Embodied energy, primary production	109	-	120	MJ/kg
CO2 footprint, primary production	6.67	-	7.35	kg/kg
Water usage	597	-	660	l/kg

**Processing energy, CO2 footprint & water**

Polymer extrusion energy	5.9	-	6.52	MJ/kg
--------------------------	-----	---	------	-------

Material properties from an example datasheet

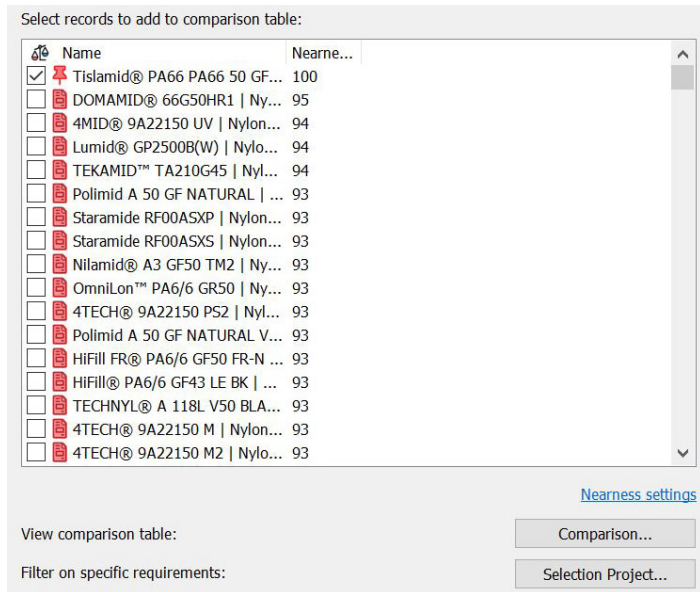
MaterialUniverse contains over 4,000 engineering materials with technical, economic and environmental data, linked to specialized datasets with many thousands more specific grades, standards, and test and design data. Data is available for polymers, metals, composites, aerospace materials, additive manufacturing materials and many more. Curve data and temperature-dependent data is included in many datasets.



An unrivalled library of materials property data

For quick screening, Granta Selector users can use “FIND SIMILAR: to get an initial set of materials similar to their current choice.

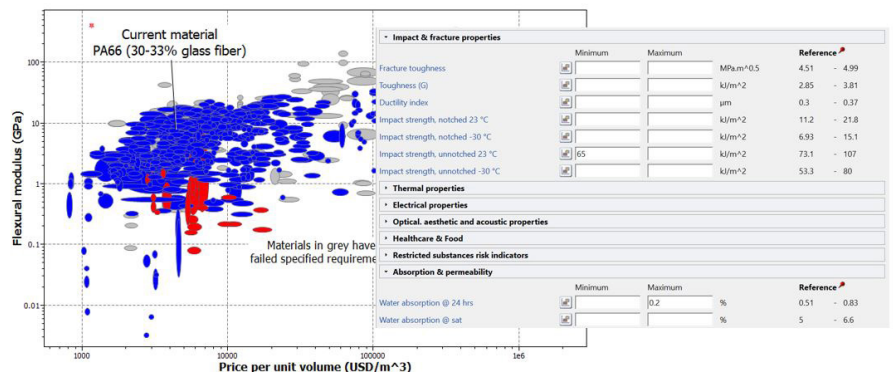
- ✓ Generic data
- ✓ Design allowables
- ✓ Producer datasheets
- ✓ Standards & designations
- ✓ Test data



Find similar function in Granta Selector

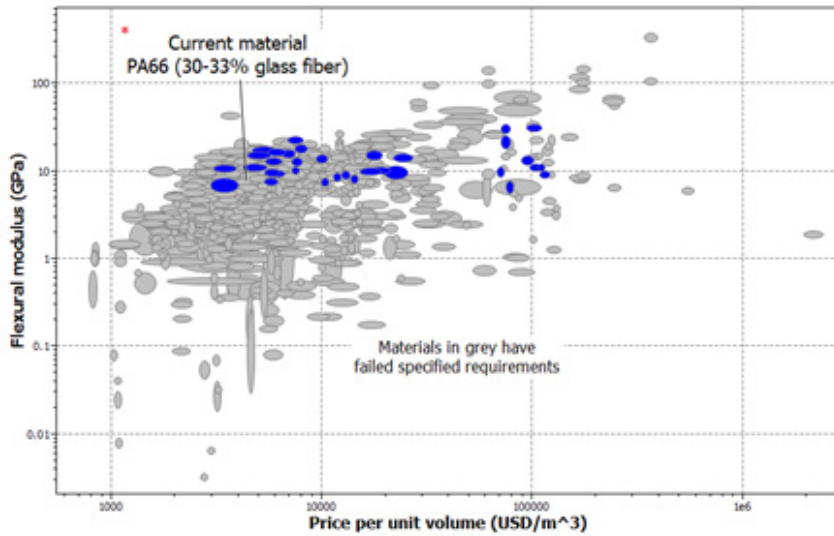
Typically, there will be constraints on the key engineering properties for the material according to product design and application. Using intelligent materials selection in Granta Selector, these constraints can be applied to filter available materials on any combination of properties:

- Physical
- Mechanical
- Impact and fracture
- Electrical
- Magnetic
- Optical, aesthetic and acoustic



Inputting criteria for comparison

Visual comparison and trade-offs between competing requirements are easy using selection graphs. The hundreds of candidate materials are quickly reduced to a small subset of alternatives with the right material properties to act as a suitable replacement.



Identification of optimal replacement candidates

Finally, an alternative material can be identified. Any larger differences in performance are clearly highlighted to facilitate engineering judgment on whether they are significant for this application. Key material properties can be exported into Ansys products to aid simulation and modeling.

With this alternative material, Selector can help you locate suppliers or specific grades, and help you to start sourcing discussions with in-house procurement or purchasing departments.

Make smarter materials decisions with Granta Selector.

	PA66 (30-33% glass fiber)	PP (50% long glass fiber)
<b>Composition overview</b>		
Material family	Plastic (thermoplastic, semi-crystalline)	Plastic (thermoplastic, semi-crystalline)
Base material	PA66 (Polyamide/nylon 66)	PP (Polypropylene)
% fiber by weight (%)	30 - 33	50
<b>Mechanical properties</b>		
Young's modulus (GPa)	6.11 - 7.62	+37% ↑
Specific stiffness (MN.m/kg)	4.47 - 5.59	+40% ↑
Yield strength (elastic limit) (MPa)	138 - 140	-6% ↓
Tensile strength (MPa)	142 - 156	-11% ↓
<b>Durability</b>		
Water (fresh)	Excellent	Excellent
Water (salt)	Excellent	Excellent
Weak acids	Unacceptable	Excellent ↑
Strong acids	Unacceptable	Excellent ↑
Weak alkalis	Acceptable	Excellent ↑
Strong alkalis	Acceptable	Excellent ↑
Organic solvents	Excellent	Excellent
<b>Thermal properties</b>		
Melting point (°C)	260 - 265	-35% ↓
Glass temperature (°C)	54 - 66	-111% ↓
Heat deflection temperature 0.45MPa (°C)	252 - 279	-31% ↓
Heat deflection temperature 1.8MPa (°C)	227 - 254	-26% ↓
Vicat softening point (°C)	235 - 255	-23% ↓

- Sanity check on lowest cost + higher modulus candidate  
PP-50% LGF
- 35% higher stiffness  
10% lower strength
- Better chemical resistance
- Poorer thermal properties  
Is this a problem?

Comparing replacement material side-by-side

**ANSYS, Inc.**  
 Southpointe  
 2600 Ansys Drive  
 Canonsburg, PA 15317  
 U.S.A.  
 724.746.3304  
 ansysinfo@ansys.com

If you've ever seen a rocket launch, flown on an airplane, driven a car, used a computer, touched a mobile device, crossed a bridge or put on wearable technology, chances are you've used a product where Ansys software played a critical role in its creation. Ansys is the global leader in engineering simulation. We help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and engineer products limited only by imagination.

Visit [www.ansys.com](http://www.ansys.com) for more information.

Any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

© 2022 ANSYS, Inc. All Rights Reserved.