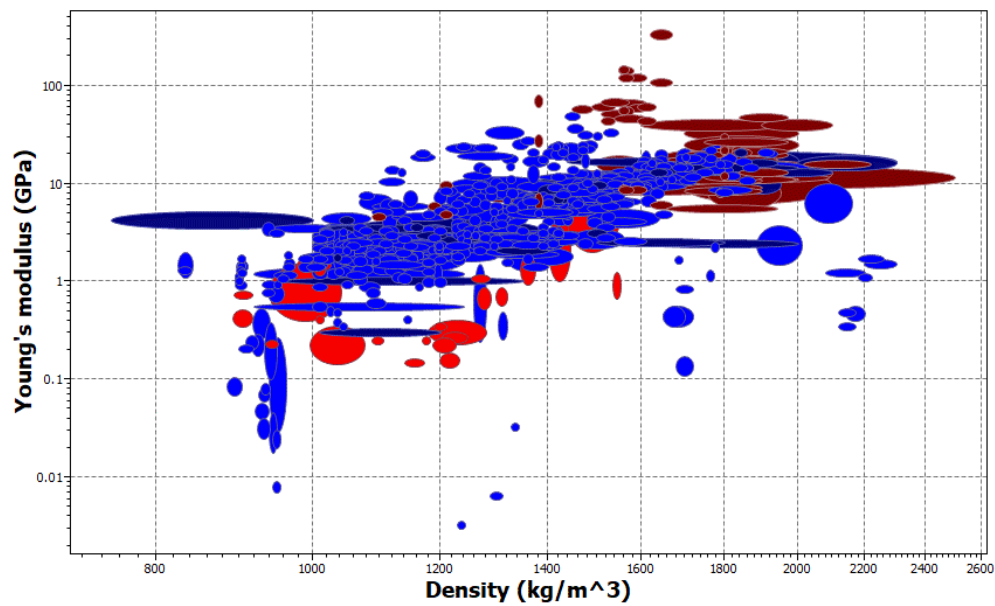




GRANTA SELECTOR

# Getting Started with Granta Selector

## Browse, Search & Chart



# 1 About these exercises

The Getting Started exercises provide an overview of the key tools and features in *Granta Selector*, and form a set of tutorials to help you familiarize yourself with the software. You can choose whether to work through them in order, or complete only the exercises relevant to you. They are intended for use with *Granta Selector 2021 R2*, and may not work correctly with earlier or later versions of *Granta Selector*.

There are also [Quick Start Videos](#) provided online to teach you about *Granta Selector*. These can be used independently of the videos, or alongside them, to test and check your knowledge.

This document contains an introduction to the main selection tools in *Granta Selector*, in addition to exercises covering use of the Browse and Search tools to find materials, and how to plot material properties from the database.

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## Document conventions

In this document:

- ❖ Each step of the exercises is shown on a gold background, like this.

More detailed instructions appear below the main instruction.

Text on elements in the software (such as buttons, dialogs and tabs) appears in bold, **like this**. The names of records, datatables, and documents are emphasised *like this*. Words and numbers that you type as you follow the instructions appear in monotype, like this.

## 2 Introduction to the main tools in *Granta Selector*

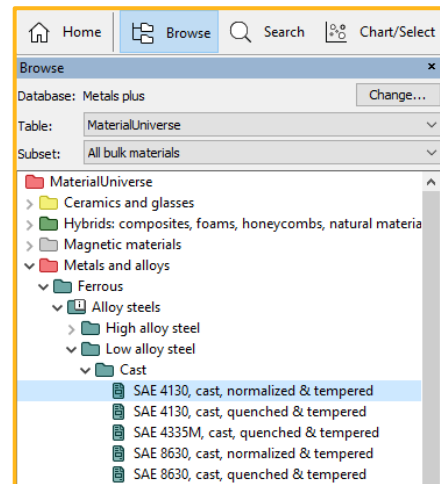
There are three main tools in *Granta Selector*: **Browse**, **Search**, and **Chart/Select**.

### 2.1 Browse

The Browse tree allows you to explore the database, drilling down into the database record hierarchy. Records in the database are presented in a hierarchical tree structure, table by table. At the top level of the tree are the main ‘families’ of materials. At the lowest level are specific materials.

In the *MaterialUniverse* table (shown left), material records are organized into four broad ‘families’: ceramics and glasses, hybrid materials, metals and alloys, and polymers. Each family is made up of ‘classes’ (*Ferrous*, *Precious metal alloys*, for example) which may contain ‘sub-classes’ (*Alloy steels*, *Low alloy steel*, *Cast*) consisting of many ‘members’ (*SAE 4130*, for example).

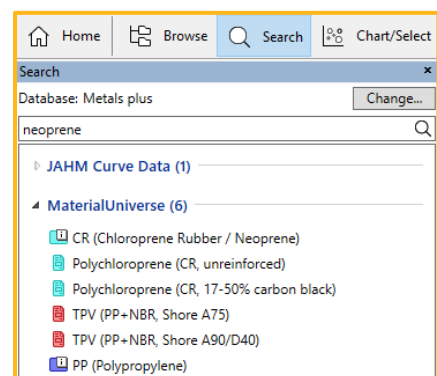
The categories and hierarchy presented in the Browse tree are specific to each data table: for example, in *ProcessUniverse*, the records contain process data rather than material data, and are organized by process type: *Joining*, *Shaping*, or *Surface treatment*.



### 2.2 Search

You can find materials or processing methods using a simple keyword search. Double-click a record in the Search results list to open its datasheet; the search term will be highlighted wherever it appears.

You can also perform more advanced queries here, for example, using **AND**, **OR** and **NOT**, or searching for phrases ("steel alloy").



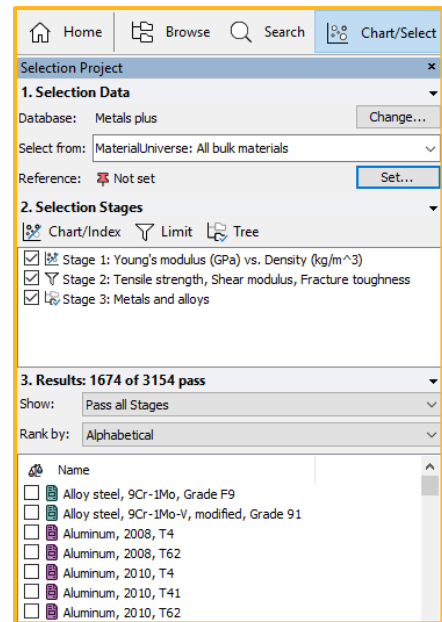
## 2.3 Chart/Select

The central hub of *Granta Selector* is a powerful selection engine that identifies records that meet an array of design criteria and enables trade-offs between competing objectives.

*A simple, dialog-based user interface* guides you through a systematic rational selection process, making it quick to apply the methods pioneered by Granta founder Professor Mike Ashby.

*Graphical tools* enable you to make and present decisions. Explore materials space, focus on likely candidates, study trade-offs between cost, engineering performance, and eco behavior.

*Structured, repeatable methods* ensure you make the right materials choice for your application, for example to optimize performance per unit of function, and to minimize cost.



### 3 Exercises

#### Exercise 1: Opening a database

When you start *Granta Selector* (after checking out licenses, if applicable), the **Databases** window will appear. All available databases are displayed. The following exercises use the *MaterialUniverse* and *ProcessUniverse* tables, which are always included with *Granta Selector*.

When you select a database name in the **Databases** window, the database homepage then appears. Hover over a data module to see the data tables it contains. For example:



Click the **More information on data and usage** link to see a detailed description of a data module.

#### ❖ Select different tables and read about the available data and applications

Click a table in the database Homepage to select it and see information about it. You can also change the selected table from the graphic on the **More information** page.

#### ❖ Change to the *ProcessUniverse* table

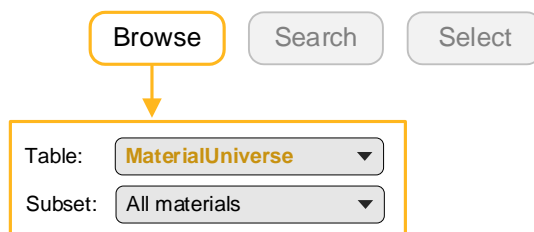
Click **MaterialUniverse > Processes** and notice that the Browse tree updates.

#### ❖ Close the Homepage

Click the cross at the top of the Home tab. This page can be reopened at any time by clicking **Home** on the main toolbar.

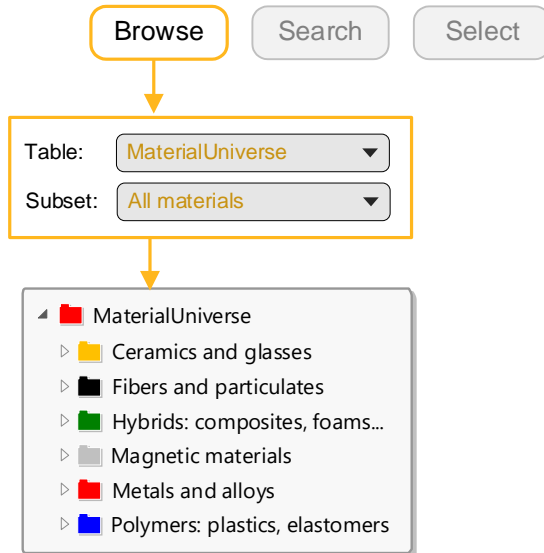
#### ❖ Change to the *MaterialUniverse* table

With the Homepage closed, navigate to different tables using the **Table** list in the Browse window.



## Exercise 2: Browse Materials


- ❖ Select the **Table** *MaterialUniverse* and the **Subset** *All materials*.



- ❖ Browse for a record for *Stainless Steel*


- ❖ Browse for a record for *Concrete*

- ❖ Open the generic record for *Polypropylene*

Generic records are records at the folder level and give general information on the material, rather than data on a specific variant. They have their own icon: .

- ❖ Open a specific *Polypropylene* record

Double-click the record name in the tree to view the datasheet.

Click  next to the property name to view design notes, which provide background information on properties, test notes, and selection guidelines. For more information on the underlying science, follow the hyperlink to the Science Note.

Right-click the datasheet to see a menu with further actions e.g., locate the record in the Browse tree, copy the datasheet, print the datasheet, or export the data to an FE package format.

- ❖ Find processes that can shape *Polypropylene* using the *ProcessUniverse* link at the bottom of the datasheet

## Part of a datasheet for a filled polypropylene material:

Polymers: plastics, elastomers > Plastics > Thermoplastics > [PP \(Polypropylene\)](#) > Barium sulfate filled >**General information**

Included in Material data for simulation	✓
<b>Designation</b> ⓘ	
Polypropylene (65-70% barium sulfate)	
<b>Tradenames</b> ⓘ	
Nilene; Denilen	
<b>Typical uses</b> ⓘ	
Furniture, buckets, bowls, general mechanical parts, bottle crates, toys, medical components, washing machine drums, pipes, battery cases, bottles, bottle caps, bumpers, films for packaging, fibers for carpeting and artificial sports surfaces.	

**Composition overview****Compositional summary** ⓘ

(CH <sub>2</sub> -CH(CH <sub>3</sub> )) <sub>n</sub> + 65-70% BaSO <sub>4</sub> filler	
Material family	ⓘ Plastic (thermoplastic, semi-crystalline)
Base material	ⓘ PP (Polypropylene)
% filler (by weight)	ⓘ 65 - 70 %
Filler/reinforcement	ⓘ Mineral
Filler/reinforcement form	ⓘ Particulate
Polymer code	ⓘ PP-MD70

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

Polymer	ⓘ	30	-	35	%
BaSO <sub>4</sub> (barium sulfate)	ⓘ	65	-	70	%

**Price**

Price	ⓘ	* 0.873	-	1.06	GBP/kg
Price per unit volume	ⓘ	* 1.65e3	-	2.14e3	GBP/m <sup>3</sup>

## The design note for Young's modulus:

**Young's modulus**

Stiffness in tension (also called Tensile Modulus, Elastic Modulus, Modulus of Elasticity).

**Test notes**

Young's modulus (E) is the slope of the initial linear-elastic part of the stress-strain curve in tension.

**Material selection notes**

Use to select materials with sufficient stiffness (high value) or sufficient compliance (low value).

Modulus in tension, flexure, and compression are similar for most materials so can be interchanged for approximate work.

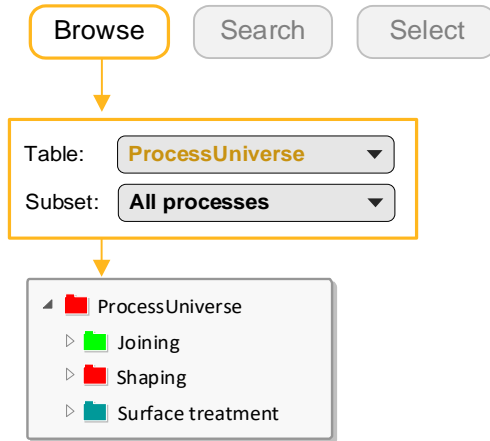
Typical values:

Flexible plastics and elastomers	< 1 GPa
Unfilled plastics	1–4 GPa
Reinforced plastics	5–25 GPa
Ferrous metals	70–250 GPa
Non-ferrous metals	10–310 GPa
Technical ceramics	20–700 GPa
Ceramics and glasses	1–120 GPa

Click to see [science note](#).

## Exercise 3: Browse Processes

- ❖ Select the *ProcessUniverse* Table and the *All processes* Subset.



- ❖ Browse for a record for *Friction welding (metals)*

- ❖ Browse for a record for *Transfer molding*

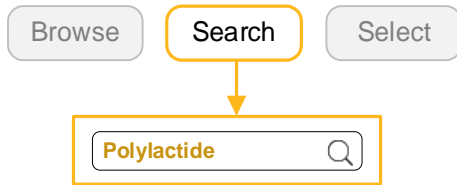
- ❖ Browse for a record for *Ion implantation*

- ❖ Find materials that can be die cast, using the link to *MaterialUniverse* at the bottom of a record for *Die casting*



## Exercise 4: Searching

### ❖ Find the material *polylactide*



### ❖ Find the process *Vacuum-assisted RTM*

The folder name is also included in the search. If the term appears in a folder name, all records under that folder will be returned; for example, a search for ceramic would return all records in the folder named *Ceramic*.

### ❖ Find materials for *cutting tools*

Text on the datasheet is also included in the search.

### ❖ Enter the search term *alum\**

*alum\** returns records starting with “alum”, such as *Alumina*, *Aluminum*, and *Alumino*.

## More advanced searches

The following search operators are available:

<b>AND</b>	Finds records containing both the search terms, so <i>steel AND alloy</i> returns only records containing both the words “steel” and “alloy”
<b>OR</b>	Finds records containing either search term, so <i>steel OR alloy</i> returns all records that contain “steel”, “alloy”, or both
<b>NOT</b>	Finds records containing the first search term, but not the second, so <i>steel NOT alloy</i> returns only records with the word “steel” but without the word “alloy”
<b>Phrase Search</b>	Finds the exact search term, so “ <i>steel alloy</i> ” will return only records containing the exact phrase “steel alloy”
<b>Parentheses</b>	Used to group search terms, so <i>iron AND (ore OR cast)</i> will return the records containing “iron” and containing either “ore”, “cast”, or both

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**Note:** AND operators are automatically added when a search has two or more terms and no other operators have been entered.

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## Exercise 5: Create a bar chart

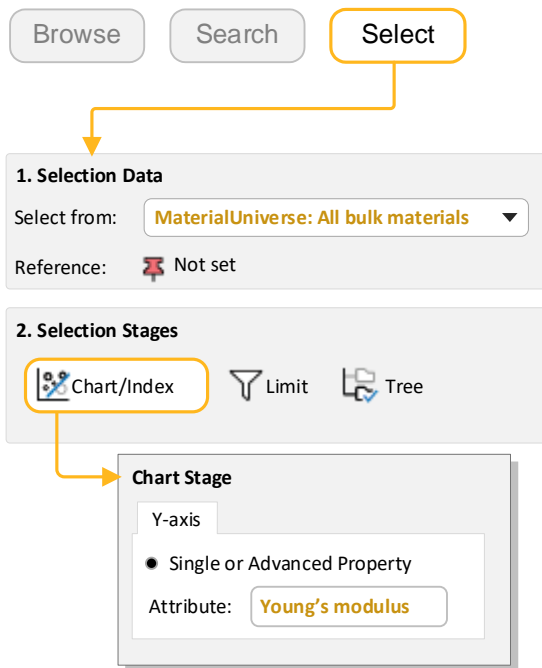
❖ Select *MaterialUniverse: All bulk materials*

❖ Make a bar chart of Young's Modulus (E)

Under Selection Stages, click **Chart/Index**.

Set the y-axis attribute to **Young's modulus**, then click **OK**.

For a bar chart, you do not set an x-axis, so leave x-axis set to <None>.



❖ Explore the chart

Click **Zoom in**  and then drag to zoom in on an area of the chart.

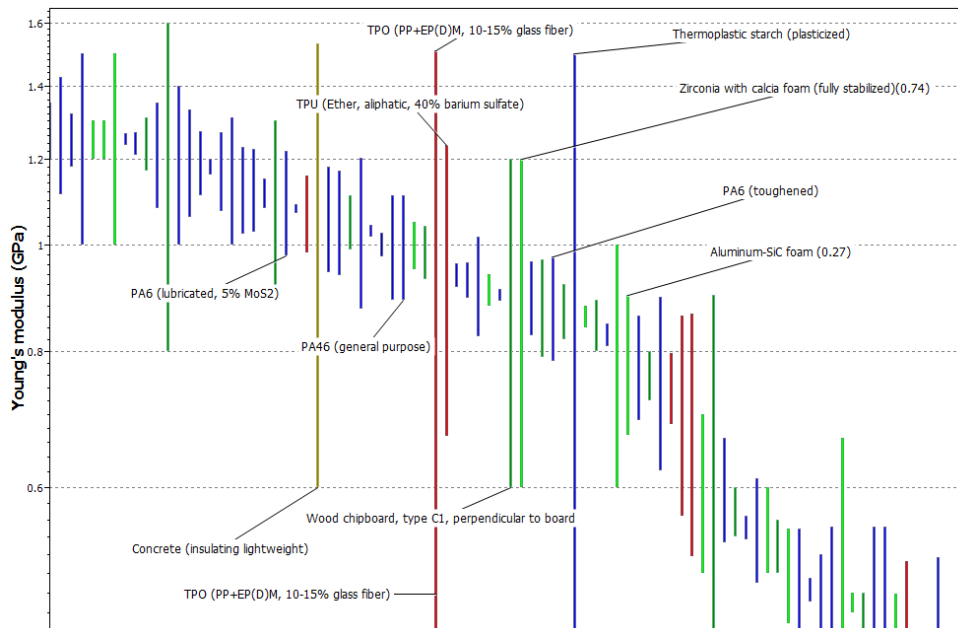
Click **Zoom out**  to zoom out.

Click **Autoscale**  to zoom back to view the whole chart again.

❖ Label records on the chart

Click a record in the chart and then drag to add and position a new data label.

To delete a data label, select it and press DELETE. To delete all labels in the chart, press CTRL+A and then press DELETE.



Labelled bar chart of Young's modulus

## Exercise 6: Create a bubble chart

- ❖ Make a bubble chart plotting Young's Modulus ( $E$ ) against Density ( $\rho$ )

Under Selection Stages, click **Chart/Index**.

Set the y-axis to **Young's modulus** and set the x-axis to **Density**.

Use the **Axis Settings** defaults to create a log-log plot.

Browse Search **Select**

1. Selection Data  
 Select from: MaterialUniverse: All bulk materials  
 Reference: Not set

2. Selection Stages  
**Chart/Index** Limit Tree

Chart Stage  
 X-Axis  
 ● Single or Advanced Property  
 Attribute: Density  
 Y-Axis  
 ● Single or Advanced Property  
 Attribute: Young's modulus


### ❖ Show family envelopes

Click  to look at how data for a given family of materials cluster together.

### ❖ Label records on the chart

**Zoom in**  and label some records (click a record and drag).


Try adding labels from the **Results** list: right-click a record in the list, select **Label** on the shortcut menu, and then drag the label to where you want it on the chart.

If the new label isn't visible at the current zoom level, click **Autoscale**  to display the whole chart again.

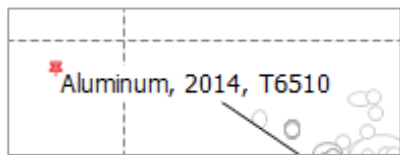
### ❖ Set a reference record

Right-click a record name in the Browse tree and select **Set as Reference**.

### ❖ Locate the reference record on the chart

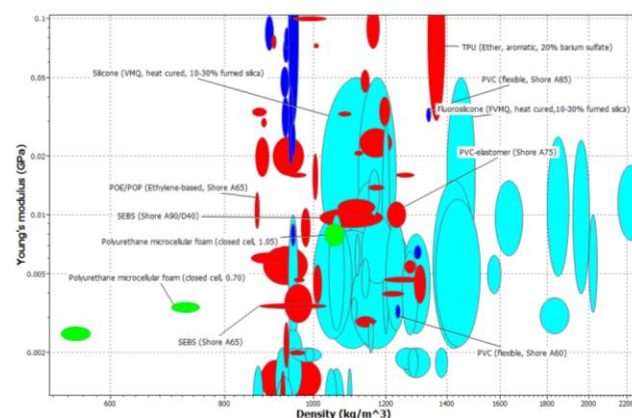
Click **Highlight reference record**  on the Chart Stage toolbar; all records except the reference record are grayed out.

Label the reference record. Note that the label includes a special reference record indicator:



### ❖ Delete this stage

Select the stage in the **Selection Stages** list and press DELETE.



Bubble chart showing Young's modulus ( $E$ ) plotted against density ( $\rho$ )

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