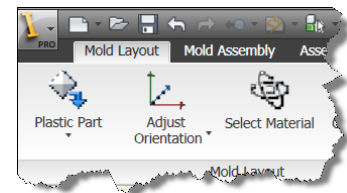


AIT Material Searching Tips

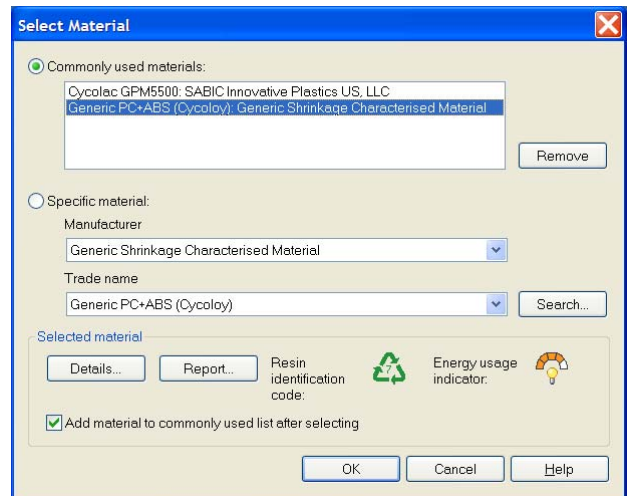
One of the beginning steps in using Autodesk Inventor Tooling (AIT) is searching for and selecting an appropriate plastic material for your part’s particular application. This is an important step as different materials will process and behave very differently from one another, which will in turn effect how the injection mold is designed and constructed. You may have an idea of what general material family you may want to consider or a specific resin that you want to select. In either case, read on for some tips to help you quickly select your intended plastic material for AIT.

Select Material Dialog Overview

Access the Select Material dialog by clicking **Select Material** on the Mold Layout tab of the Mold Design ribbon. Let us review the Select Material dialog.



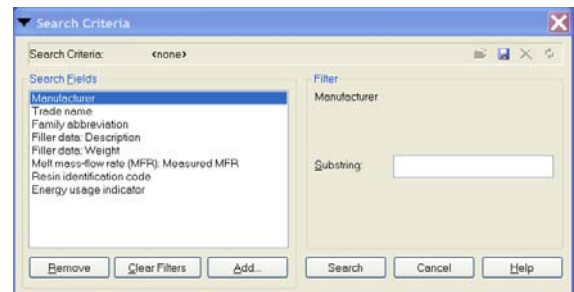
- **Commonly used materials** - list materials that have been used most often.
- **Remove** - deletes the selected material from the commonly used materials list.
- **Manufacturer** - contains a listing of every resin manufacturer in the database.
- **Trade name** - lists the selected Manufacturer’s material trade names in the database.
- **Search** - accesses a detailed search dialog box allowing you to find your required material.
- **Details** - allow you to view the specific properties of the selected material.
- **Report** - initiates a summary window of the selected material’s properties and test methods.
- **Resin identification code** – material family code commonly referred to as the plastic’s recycling code.
- **Energy usage indicator** - a relative value of a material’s processing efficiency. The lower the value the more energy efficient the material is.
- **Add material to commonly used list after selecting** - populates the selected material in the commonly used materials list.



One can simply use the pull-down arrow in the **Manufacturer** and **Trade name** areas to manually browse for a material in the select material dialog or use the search tools and techniques outlined below.

Search Criteria

After selecting the **Search** button in the select material dialog, the Search Criteria dialog appears. Eight different search filters appear by default under the **Search Fields** header. The most common ones you will use are highlighted below but keep in mind that there are over 140 search fields that you can use by selecting the **Add** button. Use the **Remove** button to remove search fields and the **Clear Filters** button to reset the search fields to blank.



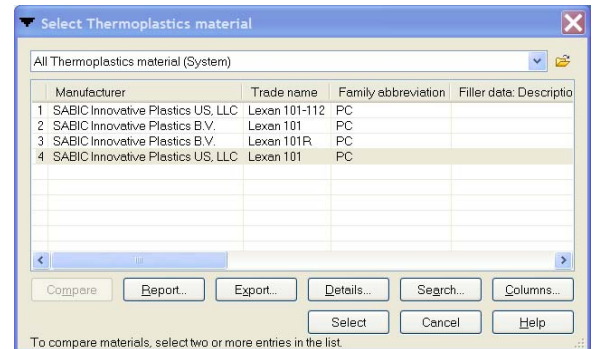
Common search fields with examples:

- **Manufacturer** (Generic, DuPont, BASF, SABIC Innovative Plastics, Basell, Bayer, INEOS, Solvay)
- **Trade name** (Cyclocac, Zytel, Lexan, Valox, Capron)
- **Family abbreviation** (ABS, HDPE, PA66, PBT, PC, PET, PMMA, POM, PP, PPS, PS, PVC, TPE)
- **Filler data: Description** (Glass fiber, calcium carbonate, mineral, talc)
- **Filler data: Weight** (1, 5, 10, 15, 20, 30, 33, 35, 40, 50%)
- **Resin identification code** (1, 2, 3, 4, 5, 6, 7)

Tip: Using the **Generic Shrinkage Characterised Material** Manufacturer is a great way to use a representative material for a chosen material family. This is especially useful if you know the material family you want to use but not a specific resin grade.

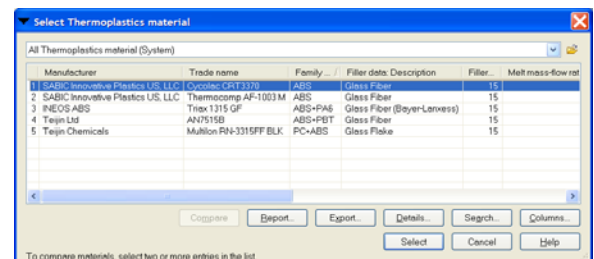
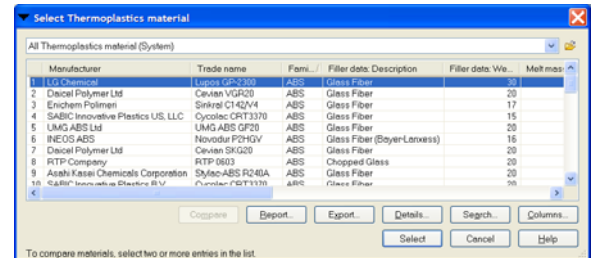
Searching Example 1: Find the material Lexan 101

1. Click the **Search** button on the Select Material dialog.
2. Select **Trade name** in the Search Fields list.
3. In the Substring text box on the right, enter [lexan 101] and click the **Search** button.
4. A new dialog named Select Thermoplastics material will appear showing several grades. In this case, we want the US version of the base material listed as number 4 in the image to the right. Read on to see how we could use the Compare feature to investigate these different grades of material.




Searching Example 2: Find an ABS material with 15% GF

1. Click the **Search** button on the Select Material dialog.
2. Select **Family abbreviation** in the Search Fields list.
3. In the Substring text box on the right, enter [abs].
4. Select **Filler data: Description** in the Search Fields list.
5. In the Substring text box on the right, enter [glass] and click the **Search** button.
6. The Select Thermoplastics dialog appears. This dialog can be resized by dragging the corners of the window or individual columns can be resized by moving your cursor in between the column headings until it changes to a double arrow cursor and then left-clicking and dragging.
 - Some of the materials listed are ABS blends of several materials in the **Family abbreviation** column.
7. Click the **Family Abbreviation** column heading to sort the column so the ABS materials are sorted to the top.
8. Click the **Search** button.
9. Select **Filler data: Weight** in the Search Fields list.
10. In both Substring text boxes (Min and Max) on the right, enter [15] and click the **Search** button.
11. There are two SABIC materials that meet our requirements disregarding the other three blended materials.
12. Click on the **Cyclocac CRT3370** material grade and then click the **Select** button.




Saving and Loading Searches

A time saving feature is to save your search criteria for future use. This is especially useful if you find yourself using search fields that you have to constantly add. To save a material search:


1. Define the required search criteria as outlined in the previous section.
2. Click the  (**Save Search Criteria As**) diskette icon located in the upper right corner of the Search Criteria dialog.
3. Enter a name into the **Search Criteria Name** box and click **Save**.

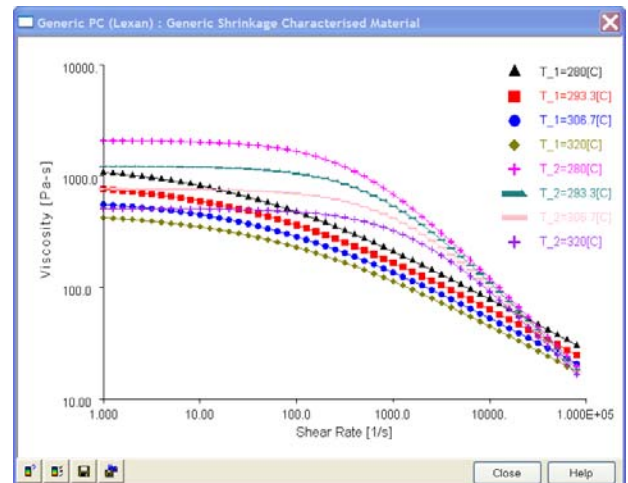
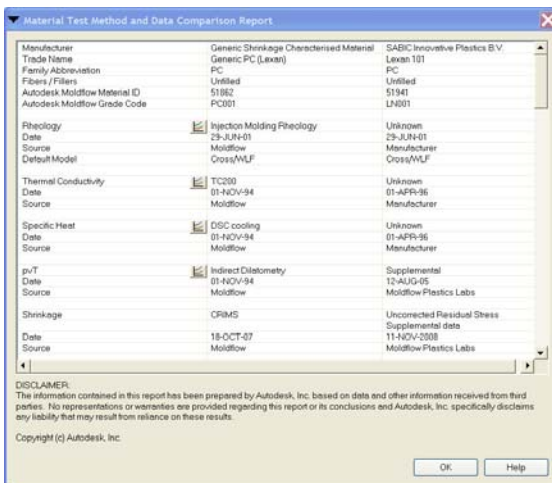
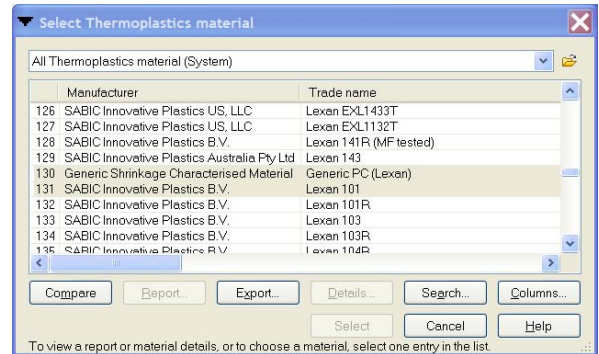
To load saved search criteria:

1. Click the  (**Load Search Criteria**) folder icon located in the upper right corner of the Search Criteria dialog.
2. Select the appropriate search criteria name from the drop-down list.

Comparing Materials

There is a comparison tool in AIT that allows you to select multiple plastic materials in the database to evaluate side by side. To compare two or more materials:

1. Define the required search criteria and click the **Search** button as outlined in the previous Search Criteria section.
2. Select one material grade by left-clicking on that specific grade, then hold down the Ctrl key and click on subsequent material grades. Selected grades should now be highlighted.
3. Click the **Compare** button.
4. Examine the report or graphs to view the differences between your selected material grades.
 - a. For example, click  (**Rheology graph**) icon to see the viscosity curve comparison. Although the two materials shown are both Lexan polycarbonates they exhibit significantly different shear thinning behavior as depicted in the shape of their viscosity curves below (T₁ vs T₂).



Similar Material

Even though the Autodesk Moldflow Material Database contains over 7,750 plastic materials it is possible that you may not find the specific material grade you are looking for. The best method to get the most accurate results would be to contact Autodesk's Moldflow Plastics Labs about testing your specific material (mplmoldflow@autodesk.com) or the material supplier of the resin in question. However, if you just want a similar material, knowing the accuracy consequences, you can use the following list to search for a suitable replacement material that closely matches the material you desire.

1. Family abbreviation
2. Trade Name
3. Filler, color, additives
4. Melt mass-flow rate, melt flow index or viscosity index
5. Viscosity curves using the compare tool outlined in the previous section
6. Transition temperature
7. Thermal conductivity
8. Heat capacity
9. Density and PVT (Pressure-Volume-Temperature)
10. Mechanical properties

Conclusion

As you have witnessed by reviewing this paper, Autodesk Inventor Tooling has a wealth of plastic material data in its Autodesk Moldflow Material Database. Finding the specific material you want can be a daunting task but AIT's material searching capabilities make it easy to find, review and compare materials. Once the material is selected it is used to simulate and optimize your mold design using the integrated Moldflow analysis tools to determine ideal gating locations, process parameters, assess shrinkage and solve moldability issues early in the design phase to avoid costly tool modifications later during production.

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Matt is an Application Engineer with IMAGINiT Technologies, specializing in mechanical engineering solutions. Matt provides training, support and implementation on Autodesk manufacturing and data management solutions software. He has extensive experience in the computer software and plastics industries working as a tech support engineer, trainer, design engineer and solutions specialist. He has also adjunct lectured at Penn State University and the University of Massachusetts – Lowell.



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