

Exercise 13

Fig. X13-1

Material Selection



Material Selection Using the Internet. The very interesting and increasingly important field of material science involves determination of the properties of a material needed for an application and then selection and testing of possible materials. A very useful site for selecting polymers and metals for particular applications is:
<http://www.matweb.com/>

Before searching for a material, you should familiarize yourself with the site, its capabilities and some of the properties in its database. To begin this process, the exercises below will help you learn how to navigate around the site.

1. Determination of some properties of aluminum. At the site, type in aluminum in the search box at the top, enter, and then scroll down and determine the data requested below.

density (g/cm³) _____

electrical resistivity (ohm-cm) _____

melting point (°C) _____

2. Determination of some properties of Plexiglas VO52. At the site, enter in Plexiglas in the search box. On the next screen, click on Plexiglas VO52.

kind of polymer _____

water absorption (%) _____

Vicat softening point (°C) _____

transmission visible (%) _____

As an example of a search for a material, consider the selection of a polymer for use as a coating on a magnetic stirring bar. Some of the properties that are needed are: high melting point [The stirring bar is sometimes used in solvents at their boiling points and melting would be very undesirable. As some solvents boil above 200°C (see **Appendix B** and/or <http://murov.info/orgsolvents.htm>), a good starting lower limit for the melting point would be 300°C.], a low coefficient of friction (<0.1) will facilitate spinning and low water absorption (<0.1%) should inhibit water penetration to the magnet. At the site, select “Physical Properties”. For material properties, set melting point at a minimum of 300°C and a maximum of 1000°C and the coefficient of friction minimum and maximum of 0.002 of 0.1 respectively and 0.1 for the minimum and maximum percents for water absorption. “Find” should result in many different forms of teflon or PTFE. Some but not all meet the requirements that you have inserted. The exercises that follow will encourage you to navigate yourself around the site to determine suitable plastics and metals and/or metal alloys for specific applications. If too many possibilities result from a search, put more limited restrictions on the properties. One way to do this is to preselect the type of material such as metal or polymer.

3. Material selection - Polymers



a. 2 L bottle

Fig. X13-2

desirable properties _____

possible plastics _____



b. frying pan coating

Fig. X13-3

desirable properties _____

possible plastics _____



c. cell phone case

Fig. X13-4

desirable properties _____

possible plastics _____



d. food storage bags

Fig. X13-5

desirable properties _____

possible plastics _____

4. Material selection - Metals and/or Metal Alloys



a. bicycle frame

Fig. X13-6

desirable properties _____

possible metals _____



b. solder

Fig. X13-7

desirable properties _____

possible metals _____



c. electrical wire

Fig. X13-8

desirable properties _____

possible metals _____



d. nails

Fig. X13-9

desirable properties _____

possible metals _____