

CHAPTER 9 Material properties and heat treatment processes

Test your knowledge 9.2

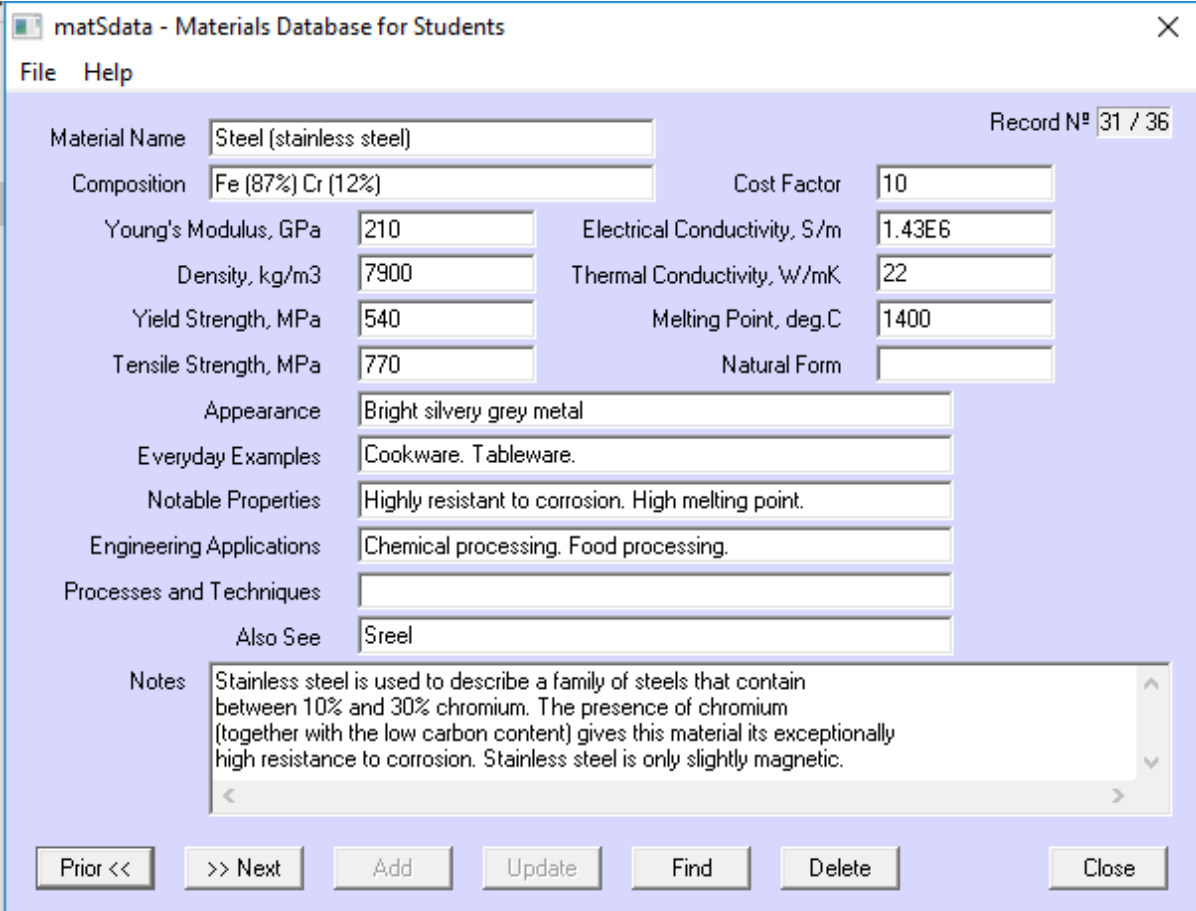
Length; cross-sectional area; resistivity (or specific resistance); temperature.

Test your knowledge 9.3

Soft magnetic materials (such as soft iron) can be magnetised by placing them in a magnetic field. They remain magnetised as long as the field is present. Hard magnetic materials (such as high carbon steel) can also be magnetised by an external magnetic field but they retain their magnetism when the field is removed. Such materials are often referred to as *permanent magnets*.

Activity 9.3

The most appropriate material is stainless steel (other steel alloys may also be suitable provided that they have appropriate tensile strength and melting point). The matSdata entry for stainless steel is shown below:



The screenshot shows the 'matSdata - Materials Database for Students' application window. The interface is light blue with a menu bar containing 'File' and 'Help'. The main area displays the following data for 'Steel (stainless steel)' (Record N° 31 / 36):

Material Name	Steel (stainless steel)	Record N°	31 / 36
Composition	Fe (87%) Cr (12%)	Cost Factor	10
Young's Modulus, GPa	210	Electrical Conductivity, S/m	1.43E6
Density, kg/m ³	7900	Thermal Conductivity, W/mK	22
Yield Strength, MPa	540	Melting Point, deg.C	1400
Tensile Strength, MPa	770	Natural Form	
Appearance	Bright silvery grey metal		
Everyday Examples	Cookware. Tableware.		
Notable Properties	Highly resistant to corrosion. High melting point.		
Engineering Applications	Chemical processing. Food processing.		
Processes and Techniques			
Also See	Sreel		
Notes	Stainless steel is used to describe a family of steels that contain between 10% and 30% chromium. The presence of chromium (together with the low carbon content) gives this material its exceptionally high resistance to corrosion. Stainless steel is only slightly magnetic.		

At the bottom of the window, there are several control buttons: 'Prior <<', '>> Next', 'Add', 'Update', 'Find', 'Delete', and 'Close'.

Test your knowledge 9.7

Copper: electrical conductors, cables, bus bars, etc.

Brass: bolts, nuts, screws, small gear wheels

Aluminium: aircraft fuselages and panels, small enclosures.

Test your knowledge 9.9

The cold chisel should be quench hardened by first polishing and then tempering by reheating it to a purple surface oxide colour (280°C) followed by immediate quenching in oil or water (see Table 9.2 on page 243).