Australian Government

MEM48030 Apply materials selection analysis techniques

Release: 1

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Modification History

Release 1. New unit.

Application

This unit defines the skills and knowledge required for applying basic formal material selection procedures for engineering and manufacturing applications involving common engineering materials, including metals, polymers, composites and ceramics. Selection is undertaken within design requirements and guidelines and includes working within limits and critical constraints for material selection. The unit builds on the introductory materials skill and knowledge provided in MEM30007 Select common engineering materials and provides a basis for more in-depth technical and para-professional study of the properties and application of each material family in engineering and manufacturing.

The unit applies to engineering and manufacturing applications, including mass production, batch production, jobbing and prototyping.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

MEM30007 Select common engineering materials

MEM30012 Apply mathematical techniques in a manufacturing, engineering or related environment

Competency Field

Materials

Elements and Performance Criteria

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1. Apply materials science principles to manufacturing or engineering materials selection requirement	1.1 Identify required materials from design or material selection brief 1.2 Identify required material functions, required material processing and commercial and environmental parameters 1.3 Search databases and reference materials for relevant data 1.4 Prepare list of constraints and objectives for required materials

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	selection 1.5 Identify any requirement for expert technical or professional assistance
2. Examine constraints	2.1 Identify material property constraints 2.2 Identify commercial and environmental constraints 2.3 Eliminate materials that cannot meet constraints 2.4 Identify and rank least constrained materials
3. Select materials for manufacturing or engineering requirement	3.1 Review material selection objectives against list of least constrained materials 3.2 Select potential materials and arrange appropriate tests to confirm suitability 3.3 Review test results and use the information in the selection process 3.4 Select materials and provide alternatives based on review and testing 3.5 Produce materials selection report including traceability records for material selection process, recommendations, and supporting data

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Material families include:

- metals
- polymers
- ceramics
- composite materials.

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Common engineering materials include:	• ferrous metals:
	  • cast irons
	  • carbon and alloy steels
	  • stainless steels
	  • coated steels
	• non-ferrous metals:
	  • aluminium and its alloys
	  • copper and its alloys
	  • nickel alloys
	  • zinc
	  • titanium
	  • magnesium
	  • refractory metals
	• polymers:
	  • thermosetting
	  • thermoplastic
	  • elastomers
	• ceramics:
	  • glasses
	  • high strength (technical) ceramics
	  • low strength (non-technical) ceramics
	• hybrids:
	  • composites
	  • foams
	  • natural materials.

Material function is the role of the material in a product or process and includes one or more of:	• structural support • heat/energy transmission or insulation • containment or transmission of fluids and bulk goods • chemical or mechanical product manufacturing • environmental protection • appearance or other aesthetic function • other engineering or mechanical function
Required material processes may include one or more of the following:	• casting • forging • rolling • extrusion

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	• heat treatment
	• cold forming
	• welding
	• brazing
	• soldering
	• chemical adhesion
	• powder processes
	• hand shaping
	• finishing and coating processes:
	  • polishing
	  • painting
	  • electroplating.

Commercial and environmental parameters for material selection includes one or more of the following:	• availability • material safety/toxicity • purchasing cost • processing cost • transport cost • ease of transport • embodied energy • carbon equivalent • other relevant commercial or environmental considerations.
Database and reference documentation includes one or more of the following:	• safety data sheets (SDS) • standards and codes • textbooks • online technical reference databases • material and equipment supplier specifications, test data and allowable limits • NATA accredited organisations test reports and calibration certificates • other sources of specifications, test data and allowable limits.
Constraints include:	• simple constraints, i.e. a must-have requirement • limit constraints, i.e. a requirement that a feature must be above, below or between some limit.
Appropriate tests include:	• tests undertaken by a technician within the organisation • those required to be undertaken by external organisations • simple tests

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Physical properties include:	• electrical conductivity/resistivity • specific gravity/density • thermal conductivity/expansion • specific heat • phase transitions • melting/boiling points.

Mechanical properties include:	• strength
	  • yield
	  • tensile
	  • compressive
	• shear characteristics
	• torsion
	• hardness
	• impact resistance
	• fatigue resistance
	• elasticity
	• plasticity
	• ductility
	• malleability
	• creep resistance
	• visual appearance and colour
	• magnetic properties
	• corrosion resistance.

Mechanical and thermal processes include:	• casting • forging, rolling and extrusion • cold forming • powder processes • heat treatment • joining - fasteners • soldering • brazing • welding • adhesives • finishing - coatings, metallic and non-metallic.
Chemical properties include:	• corrosion processes for metals • degradation of polymers.

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Bonding includes:	• ionic • covalent • metallic • molecular.
Appropriate persons include:	• internal and external technicians, professional engineers, scientists and technical other experts.

Unit Mapping Information

No equivalent unit

Links

Companion Volume implementation guides are found in VETNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2