



Australian Government

MEM48031 Select ceramic and glass materials for engineering and manufacturing applications

Release: 1

MEM48031 Select ceramic and glass materials for engineering and manufacturing applications

Modification History

Release 1. New unit.

Application

This unit of competency defines the skills and knowledge required to recognise common ceramic and glass materials used in engineering, assist in the selection of a ceramic or glass material for a specific application, and use test results to evaluate the properties of ceramics and glass materials.

It applies to technicians and supervisors in manufacturing and engineering environments who are required to select or assist in the selection of ceramic and glass materials.

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

Pre-requisite Unit

Nil.

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. Determine job requirements	1.1 Follow standard operating procedures (SOPs) 1.2 Comply with work health and safety (WHS) requirements at all times 1.3 Use appropriate personal protective equipment (PPE) in accordance with SOPs 1.4 Identify job requirements from specifications, drawings, job sheets or work instructions
2. Identify ceramic and glass materials by their principal properties	2.1 Identify the principal properties of ceramic and glass materials used in engineering and manufacturing applications 2.2 Identify the effects of different types of bonding in ceramic and glass

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	materials 2.3 Identify the effects of mechanical and thermal processes on the principal properties of ceramic and glass materials
3. Select ceramic and glass materials for specific applications	3.1 Determine the ceramic or glass requirement for the specific application in consultation with others 3.2 Select ceramic or glass material based on the requirement and consideration of principal properties and further processing 3.3 Confirm selection according to standard operating procedures
4. Verify ceramic or glass material as fit for purpose	4.1 Identify appropriate tests for the required properties 4.2 Arrange required testing of materials with appropriate persons 4.3 Analyse test results and confirm or modify material choices based on testing outcomes

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.

Common ceramic and glass materials and properties include:	- ceramic materials including: - raw materials: clays, flints, feldspars, - ceramic structures of AX type with various coordination numbers - SiO₄ tetrahedra based structural materials and industrial ceramic products - silica SiO₂ and quartz - glass materials and properties including:
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	• vitreous or glassy state and the basic structural unit SiO₄ tetrahedra • glass formers, glass modifiers and intermediates • viscosity • mechanical properties • optical properties • tempered glass • annealed glass, effect of compression stresses in surface material • explain devitrification of glass and accompanying changes in properties, glass ceramics and applications.
Appropriate tests include those:	• undertaken by a technician within the organisation • required to be undertaken by external organisations.
Appropriate tests include tests for one or more of:	• tensile strength • compression • shear characteristics • torsion • hardness • impact resistance • fatigue resistance • creep resistance • visual appearance and colour • magnetic properties • corrosion resistance.
Appropriate persons include:	• internal technicians, scientists, engineers or other technical experts • external organisations.

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>

Assessment Requirements for MEM48031 Select ceramic and glass materials for engineering and manufacturing applications

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Performance Evidence

There must be evidence the candidate has demonstrated the ability to:

- follow work instructions, standard operating procedures (SOPs) and safe work practices
- identify and interpret specifications, drawings, job sheets and other applicable reference documents for selecting two ceramic and two glass materials
- research common engineering ceramic and glass materials by their required properties for a specific application on at least two occasions
- select and carry out tests appropriate to the material
- arrange tests appropriate to the ceramic material and analyse the results on at least two occasions
- verify selection of ceramic and glass materials.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

There must be evidence the candidate has knowledge of:

- safe work practices and procedures and use of personal protective equipment (PPE)
- general non-crystalline material features including short-range order and relationship to glasses and gels
- the vitreous or glassy state and the basic structural unit SiO_4 tetrahedra
- properties of silica (SiO_2) and quartz including vitreous or fused silica
- safe working practices to take into account when selecting silica and quartz materials for an application
- engineering ceramics:
 - glass ceramics and applications
 - causes of ceramic cracking under temperature
 - binary (e.g., $\text{MgO-Al}_2\text{O}_3$) and ternary ceramic diagrams)
- processes for manufacture of ceramic articles including:
 - raw materials
 - effect of water
 - shaping by pressure fabrication,
 - hydroplastic forming and slip casting
 - drying and shrinkage

- sintering (fixing) and associated shrinkage
- glass properties including:
 - viscosity
 - mechanical properties
 - optical properties
- glass formers, glass modifiers and intermediates and their role in glass structure
- glass treatments including tempering and annealing
- devitrification of glass and its effects on glass properties
- tests used to determine ceramic and glass properties.
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Assessment Conditions

- Assessors must:
 - have vocational competency in selecting ceramic and glass materials for engineering and manufacturing applications at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015 or its replacement* and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring State as the case requires.
- Where possible, assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- There must be suitable access to an operating plant or equipment that allows for appropriate and realistic simulation and documentation including relevant workplace procedures, industry codes and standards.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
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