



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **PMBTECH505B Choose polymer materials for an application**

**Revision Number: 1**

## **PMBTECH505B Choose polymer materials for an application**

### **Modification History**

Not applicable.

### **Unit Descriptor**

#### **Unit descriptor**

This competency covers the application of a knowledge of polymerisation, polymer structure and modifications of polymer materials to their properties so enabling the choice of an appropriate polymer compound for an applications.

This competency is typically performed by technicians developing new products or applying this knowledge set to advanced process/product problem solving.

### **Application of the Unit**

#### **Application of this unit**

This competency applies to technicians who are able to bring together an understanding of the basics of chemistry and polymers and apply this understanding to determine the properties of polymers and polymer products.

It includes:

- the influence of polymerisation mechanisms on polymer properties
- the influence of polymer structure on polymer properties
- methods of modifying the properties of raw polymers
- the selection and interpretation of polymer tests
- the ability to bring these skills together to select appropriate material(s) for an application.
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### **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

### Prerequisites

This unit of competency has a prerequisite of *PMBTECH401B Predict polymer properties and characteristics*.

## Employability Skills Information

### Employability Skills

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

ELEMENT ELEMENT	PERFORMANCE CRITERIA
1. Determine possible polymer properties based on polymer type.	<p>Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.</p> <p>1.1 Estimate molecular weight distribution changes with polymerisation mechanisms and conditions.</p> <p>1.2 Predict the impact of monomer and polymer structure on polymer properties.</p>
2. Estimate polymer properties based on polymer structure.	<p>2.1 Predict property changes caused by polarity and intermolecular forces.</p> <p>2.2 Determine possible polymer properties based on chain flexibility variations caused by changes in regularity, tacticity and intermolecular forces.</p> <p>2.3 Estimate polymer properties based on molecular weight/molecular weight distribution, degree of cross-linking.</p> <p>2.4 Predict barrier properties based on molecular orientation and degree of crystallisation.</p>
3. Choose a polymer compound for an application.	<p>3.1 Select appropriate base polymer/polymers for an application based on the polymer properties.</p> <p>3.2 Determine reinforcement(s)/additives required to meet product specification.</p> <p>3.3 Predict failure mechanism for selected compound and modify selection if appropriate.</p> <p>3.4 Determine the need for polymer compatibilisers and specify appropriate use if required.</p> <p>3.5 Develop formulation and select appropriate production</p>
4. Organise testing of polymer and interpret test results.	<p>4.1 Select appropriate test(s) for compounded polymer based on test purpose and limitations and material being tested.</p> <p>4.2 Test colour using colour coordinates as required.</p> <p>4.3 Interpret test results and modify formulation/production method as required to meet product specification.</p>

## Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit. Knowledge and understanding of the polymerisation process and polymer characteristics sufficient to enable the selection of polymers with appropriate base properties. Knowledge of organization standard procedures and policies. Knowledge of the relevant regulatory requirements and national/international standards along with the ability to implement them within appropriate time constraints and in a manner relevant to the job. This unit assumes a knowledge of basic chemistry, including atomic structure, molecular weight, periodic table, ionic and covalent bonding, intermolecular bonding, hydrogen bonding, structure of organic compounds, functional groups and typical reactions, saturated and unsaturated compounds, aromatic compounds, hydrolysis and addition reactions. Knowledge as a basis for solving processing and material problems including:

- property changes caused by different mechanisms and conditions for addition polymerisation
- typical processing conditions for typical polymers such as polythene
- property changes caused by using bulk, suspension, solution and emulsion addition polymerisation
- property changes caused by different mechanisms for condensation polymerisation
- the formation of cross-linked polymers
- the properties of cross-linked polymers
- impact of polymerisation process on polymer properties
- impact of polymer structure on polymer properties
- modifications to plastics
- test methods
- properties and applications of polymers
- the impact of tacticity on addition polymer properties
- the property changes caused by different copolymer structures
- the influence of molecular structure on chain regularity
- the difference between polymer reinforcements and polymer composites.

### Language, literacy and numeracy requirements

This unit requires high level literacy and numeracy.

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for this training package.

### Overview of assessment

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that the polymer and additive properties be understood and the chemistry behind these properties can be explained. Competence must be demonstrated in the ability to predict appropriate polymers and additives from the required properties of a product.

Consistent performance should be demonstrated. For example, look to see that selections made can be justified.

### **Assessment method and context**

Assessment will occur using industrial polymers and typical/actual applications and will be undertaken in a work-like environment.

Competence in this unit may be assessed:

- using appropriate, industrial polymers and typical/actual applications
- in a situation allowing for the generation of evidence of the ability to recognise, anticipate and respond to problems
- by using a suitable simulation and/or a range of case studies/scenarios
- through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

### **Specific resources for assessment**

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required.

Where applicable, physical resources should include equipment modified for people with disabilities.

## **Range Statement**

### **RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.

### **Context**

This competency applies to all work environments and sectors within the plastics, rubber and cablemaking industry.

### **Procedures**

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

### **Unit Sector(s)**

Not applicable.