

Study Guide

Advanced Module 510

Urethane and Amino Resins

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Summary

In this Advanced Module Urethane Resins and Amino Resins are discussed in more detail than in the level 4 modules 408 and 409 respectively.

Described are the structure of isocyanate monomers and the preparation of pre-polymers from them. Also discussed are the hazards involved in the handling and use of isocyanates. Their use in the preparation of the 5 major types of urethane coatings is explained. Their characteristics and applications are then discussed.

The functional groups in amino resins based on urea and melamine are shown and the structure of benzoguanamine given. Applications of these amino resins are given.

Structure of the Module

The module consists of 2 sections, 1 set of Self Assessed Questions (SAQ), 1 Computer Marked Assessment Questions (CMA), 2 Assignments (ASG) and an End Test (TMA).

The module is designed to take about 9 hours of study. This excludes the time taken to write up your report for the ASG.

Self-Assessment Questions (SAQ)

Are designed to enable you to check your own progress. Questions are asked as you progress through the module. You should write down your answers and then check them against the answers given in the Appendices. No marks are awarded for SAQs.

Computer Marked Assessment Questions (CMA)

Are a multi-choice question set that tests your understanding of the module. Please carry out this test before you submit any other work for marking by your tutor. These are completed online, you will need to log onto your study portal and then follow the CMA link/ instructions.

Assignment (ASG)

The ASG are an exercise in which the student research into and reports on certain objectives. You can discuss your proposed assignment with your tutor and mentor before commencing work. You will need to write a report on the assignment, which is then sent to your tutor for marking. Please see further instructions included in the Appendix on ASG Guidance Notes. Please note that there are 2 ASG's in this module

Tutor Marked Assessment (TMA)

Is a mandatory end test question paper taken under 'closed books', fully invigilated exam conditions. These are normally held on-site with an invigilator in attendance, which is normally your workplace mentor. The student or mentor will contact Lorraine Beard, and she will arrange

for the TMA and instructions to be sent, by email to the chosen invigilator, and then this is then given to the student on the day and time that has been chosen.

Marks for the module

CMA	20%
ASG's	35%
TMA	45%
	100%

An overall mark of 50% or more is necessary for successful completion of the module, with students achieving at least 40% of the marks available in each element. In addition, an overall mark of 50% – 64% must be achieved for a PASS to be awarded, an overall mark of 65% – 84% must be achieved for a Merit and over 85% for a Distinction.

Module Pre-requisites

It is essential for students tackling this advanced module to have already studied selected modules at Intermediate level, in particular, modules 408 and 409 as suggested in the summary

The main prerequisite for persons taking Modules at Advanced level, is an interest in surface coatings. Preferably, they will be employed in the coatings or a related industry. They may also be employed by a user of paints, lacquers, inks or powder coatings. In addition, they should preferably have a basic education in chemistry and physics. It would be useful if only for reference, that relevant foundation and intermediate modules had already been studied

These modules include references to scientific concepts relating to coatings technology. For example, those identified with an asterisk contain many references to chemical formulae and

reactions. Therefore, it is a requirement that you have a scientific education, with Chemistry and Physics to at least UK Advanced Level or higher, of which you can provide evidence.

[Overview of qualification levels](#)

Persons taking these modules should be employed or have recently been employed in the coatings or a related industry.

Successful completion of six modules, including at least four at level 5, entitles a student to a full, Level 5 International Certificate in Coatings Technology (ICCT), awarded by The Coatings Training Institute. However, individual certificates are also presented if the student chooses to take less than six modules.

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Module Objectives

When you have finished this module, you should be able to understand the following:

Section 1. Urethane Resins

- 1.1 Discuss the chemical structure of toluene di-isocyanate (TDI) and hexamethylene di-isocyanate (HMDI)
- 1.2 Describe the preparation of pre-polymers from TDI and HMDI
- 1.3 State the hazards involved in the handling and use of isocyanates and the special safety precautions required
- 1.4 The use of isocyanate monomers and pre-polymers in the preparation of urethane coatings
- 1.5 General properties of urethanes
- 1.6 Explain the use of isocyanate monomers and pre-polymers in the preparation of the following urethane coatings:
 - a) Type 1: one package pre-reacted;
 - b) Type 2: one package moisture cure;
 - c) Type 3: one package heat cured;
 - d) Type 4: two package catalyst;
 - e) Type 5: two package polyol.(Classification as ASTM designation)
- 1.7 Discuss the distinguishing characteristics of and applications for the urethane coatings described in 1.6

Section 2. Amino Resins

- 2.1 Explain the reaction of urea and melamine with formaldehyde and subsequently the etherification with an alcohol
- 2.2 Identify the functional groups in the resins outlined in 2.1

- 2.3 Describe the chemical structure and characteristics of benzoguanamine resins
- 2.4 Explain the reactions of the resins described in 2.1
- 2.5 Suggest suitable applications for urea-formaldehyde and melamine-formaldehyde resins