

# **Study Guide**

## **Module 409 – Level 4**

### **Epoxy and Urethane Resins**

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#### **Summary**

In this Intermediate Module, it is appropriate to discuss epoxy and urethane resin systems in two separate sections. One being one pack and the other two pack.

Firstly the structure of an epoxy resin molecule is shown, and the relationship between an epoxy ester and an oil-based alkyd explained. This is followed by a description of urethane prepolymers and the reactions of isocyanates. The manufacture of urethane oils and moisture curing urethanes and typical uses follows.

2 pack applications of epoxy and urethane resins are then discussed. Reference is made to amine and amide curing of epoxies and the hydroxy containing materials capable of reaction with urethane prepolymers. The main characteristics and typical uses of such coatings are finally given.

## **Structure of the Module**

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

The module is designed to take about approx. 9 hours of study. This excludes the time taken to write up the ASG's.

### **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	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**

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.

Most intermediate students will have studied some modules at foundation level. However, students who have not studied modules at foundation level but have a scientific



background and experience of the coatings industry should be able to benefit from this module.

Successful completion of six modules, including at least four at level 4 entitles a student to a full, Level 4 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.

Persons taking modules at Intermediate Level should be employed or have recently been employed in the coatings or a related industry. They should have studied some science and chemistry.

## **Module Objectives**

After studying this Module, you should be able to understand:

### **Section 1. Epoxy Resins and Urethanes – 1 Pack**

- 1.1 The structure of an epoxy resin molecule identifying the epoxy and hydroxyl groups
- 1.2 The relationship between an epoxy ester and a fatty acid alkyd
- 1.3 Urethane prepolymers and their reactions
- 1.4 Isocyanate reactions
- 1.5 Urethane oils and their manufacture
- 1.6 Moisture curing urethanes and typical uses

### **Section 2. Epoxy Resins and Urethanes – 2 Pack**

- 2.1 State that the epoxy group will react with a primary or secondary amine at room temperature
- 2.2 List the characteristics of 2-pack epoxy systems and state typical uses for such coatings
- 2.3 State that urethane pre-polymers containing a plurality of isocyanate groups will react with hydroxyl group-containing materials
- 2.4 Name two classes of hydroxyl containing materials used in such two-pack coatings
- 2.5 List the main characteristic of such coatings as good gloss, abrasion resistance and chemical resistance
- 2.6 State some typical uses of such coatings

