

## **Study Guide**

### **Advanced Module 511**

# **Epoxy, Acrylic and Water Reducible Resins**

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### **Summary**

In this Advanced Module Epoxy Resins and Acrylic Resins are discussed in more detail than in Intermediate Modules 409 and 408 respectively.

In the section on epoxy resins methods of quoting epoxide content of a resin is explained together with the significance of 'oil length' of an epoxy ester. Reactions between epoxy resins and phenolic, amino and polyamide resins and with amines are also described.

The section on acrylic resins concentrates on thermosetting resins and the monomers required in their formulation.

Also in this Module is a section on water reducible resins including emulsions and methods of making solutions of different types of resin with varying degrees of water reducibility or solubility.

## **Structure of the Module**

The module training material consists of 3 sections, 1 set of Self-Assessed Questions (SAQ), Computer Marked Assessment Questions (CMA), 2 tutor marked 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 the 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 1 20%, ASG 2 15%	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**

The main prerequisite for persons taking Modules at Advanced level, is an interest in surface coatings. Persons taking these modules should be employed or have recently been employed in the coatings or a related industry.

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](#)

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.

#### **Module Prerequisites**

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. Science subjects at GCSE or Advanced levels would also be an advantage.

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## **Module Objectives**

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

### **Section 1. Epoxy Resins**

- 1.1 Explain the structure of epoxy resins and epoxy esters.
- 1.2 Determine the proportions of epoxy resin and fatty acid to produce an ester of specified 'oil length'
- 1.3 Explain methods of quoting epoxide content (and hence M.Wt) of a resin
- 1.4 Explain the reaction of an epoxy resin with a phenolic resin
- 1.5 Explain the reaction of an epoxy resin with an amino resin
- 1.6 Explain the reaction of an epoxy resin with an amine
- 1.7 Explain the reaction of an epoxy resin with a polyamide resin
- 1.8 Combinations of tars and epoxy systems
- 1.9 Suggest suitable applications for epoxy resin systems

### **Section 2. Acrylic Resins**

- 2.1 List the monomers used in the preparation of thermoplastic and thermosetting acrylic resin
- 2.2 State the hazards involved in the handling and storage of polymerisation initiators
- 2.3 Explain the utilisation of the reactive groups derived from the monomers selected in 2.1 to produce cross-linkings
- 2.4 Suggest suitable applications for the various types of cross-linked acrylic resins

### **Section 3. Water Reducible Resins**

3. Describe the techniques by which media may be made water reducible
  - 3.1 Describe the three principal ways in which water reducible resins can be made
  - 3.2 Describe the processes taking place in the preparation of an acrylic emulsion polymer
  - 3.3 List some monomer combinations used in acrylic emulsions to give films with good flexibility
  - 3.4 List other resins that can be made water reducible by emulsification
  - 3.5 Explain the methods used to give polymers water reducibility
  - 3.6 Understand how oils, alkyds, epoxy, polyurethane, acrylic and amino resins can be made water reducible
  - 3.7 Compare the properties of emulsified and water reducible resins
  - 3.8 State the hazards involved in the handling and use of the raw materials used in emulsion and water reducible resins