

Study Guide

Module 417 – Level 4

Manufacture – Dispersion

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Summary

This module looks at the dispersion of pigments in media and at the techniques and mechanisms involved. Dispersion is the single most important and time-consuming operation in the manufacture of coatings. Poorly dispersed pigments produce an array of faults including settlement, poor opacity and low gloss in the finished product.

The majority of investigative work in this area has been done using liquid coatings. Here we have included references to dispersion in coating powder media.

It is expected that it will take approximately 8 to 10 hours to complete this module, including the Assignment work involved.

Structure of the Module

This module training material consists of 6 sections 1 set of Self-Assessment Questions (SAQ), 1 Computer Marked Assessment Questions(CMA), 1 Assignment (ASG) and an End Test (TMA).

This module is designed to take approx. 10 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.

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.

Objectives

At the end of this module you should be able to do the following:

Section 1. Pigments and the need for dispersion

- 1.1. Define (a) P:B ratio and (b) PVC and briefly describe their importance to coatings

Section 2. The mechanics of dispersion

- 2.1 Explain, with the aid of simple diagrams, how the rupture of a solid surface concentrates energy at the surface
- 2.2 Explain the effect of surface energy on particle size reduction and dispersion stability
- 2.3 Describe, with the aid of a simple line drawing, the four steps of a pigment dispersion process
- 2.4 Explain the following terms as they apply to pigment dispersion:
 - a) Aggregate
 - b) Agglomerate
 - c) Grinding
 - d) Dispersion
 - e) Primary Particle
 - f) Flocculate

Section 3. Effects of dispersion

- 3.1. Explain how the degree of dispersion and dispersion stability affect the properties of a pigmented coating
- 3.2. Identify and explain the conditions required for both spontaneous and mechanical wetting of pigment by medium to take place
- 3.3. Explain the stabilisation of a pigment dispersion by both electrostatic and steric mechanisms. In each case describe the theoretical and practical conditions required for the mechanism to operate

Section 4. Techniques of dispersion

4.1. Describe, with the aid of simple line drawings, the following mechanisms of pigment dispersion:

- (i) velocity gradient
- (ii) shearing
- (iii) attrition
- (iv) impaction

4.2 Explain, with the aid of a simple graph, why there is usually an intermediate binder concentration at which dispersion is easiest

4.3. Describe the procedure for determining the Daniel Flow Point of pigment dispersion, using it to determine the flow point of titanium dioxide in long oil alkyd medium and hence to calculate the composition of the optimum mill base

Section 5. Controlling the dispersion

5.1. Describe the theoretical and practical conditions required for the effective let-down of pigment dispersion

5.2. Explain problems present in the dispersion process

Section 6. Solventless coatings

6.1. List the main differences in the mechanisms involved when dispersing pigments in solventless systems

