

Intermediate Module 302

Properties of Pigments

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Module 302 is concerned overall with the properties of pigments.

The first section of the module describes the general properties of pigments for all coating types, in terms of cost, stability, variability etc. along with specific requirements for those pigments used in powder coatings.

Section 2 is dedicated to the optical properties of pigments; in particular, how pigments can affect the opacity and gloss of coatings.

Section 3 describes the general requirements of pigments for use in the area of powder coatings and the main differences here between inorganic and organic pigments.

Section 4 is concerned with the pigmentation of coatings and describes the importance of Pigment: Binder ratio, Pigment Volume Concentration and Critical Pigment Volume Concentration. The effect of PVC on a number of film properties is discussed. Finally, in this section, the effect of pigment particle shape on coating properties is described.

To finish the module, in section 5, pigment test methods used in the area of powder coatings are described for a number of important conditions.

Introduction to Module 302

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Structure of the Module

The module consists of a theory block of 5 sections, 1 CMA and 1 PAX.

The total study time will be approx. 10 – 11hr, with additional time being required for the CMA and the PAX. Experience indicates that on average, the total time to complete this module will be of the order of 4 – 6 weeks.

Marks for the module are split as follows, CMA (20%), PAX (35%) and End Test (45%).

For full certification, the CMA and the PAX must be completed satisfactorily

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.

It is advisable to wait until you have completed three modules before sitting the end tests, as this will involve only one visit to the examination room.

Module Prerequisites

It will be a distinct advantage if students tackling this Module have already studied some science subjects to GCSE or relevant GNVQ level and have completed other modules at Foundation level.

A student should be currently employed within the Coatings Industry or be with a supplier to this Industry. Past relevant experience of employment within the industry would be a distinct advantage.

SAQ – Self Assessment Questions

Although these do not carry any marks for completion, nevertheless they are important to the student, as they show that the Section has been clearly understood.

The answers to SAQs may be found in Appendix 1.

CMA – Computer Marked Assessment

The CMA may be found on the website.

PAX – Practical Attendance Exercise

There is one PAX in Module 302. This is concerned with the effect of pigment volume concentration on gloss and opacity and is fully described in Appendix 2 of the Module. A reminder of how to fill in a PAX is given in the general introduction to the module.

Module Objectives

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

Section 1 General properties and characteristics of pigments

- 1.1 Describe the general properties imparted to coatings by the incorporation of pigments and extenders
- 1.2 Describe the general characteristics of natural pigments and extenders
- 1.3 Describe the general characteristics of synthetic inorganic pigments

Section 2 Optical properties imparted by pigments

- 2.1 Describe and explain how colour is perceived
- 2.2 Show, by means of a diagram, two possible mechanisms by which a pigment may opacify a coating
- 2.3 Discuss three factors which affect hiding power, in particular, pigment particle size
- 2.4 Show by means of diagrams, how light is reflected:
 - specularly
 - diffuselyfrom the surface of a pigmented coating. Also, list two pigment characteristics which affect the type of gloss observed and explain how each has the effect described

Section 3 Describe the general requirements pigments for use in powder coatings and state the main difference between organic and inorganic pigments in this application

- 3.1 General considerations
- 3.2 Differences between organic and inorganic pigments

Section 4 Pigmentation of coatings

- 4.1 Define the terms:
 - Pigment: binder ratio
 - PVC
- 4.2 Explain with the aid of a simple graph, the regular variation of physical properties with increase in PVC
- 4.3 Explain with the aid of the graph in 4.2 and simple sketches of pigmented films, the concept of CPVC
- 4.4 Describe the effect of pigment particle shape on properties of a pigmented system.

Section 5 Pigment test methods for powder coatings

- 5.1 Describe the main pigment properties required when a pigment is to be used in powder coating systems