Study Guide

Advanced Module 501

Pigments Colour and Dispersion

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Summary

This module is concerned with a number of important aspects of pigments.

In the first section, various ways of describing colour are presented, in scientific terms. Both the Munsell and CIELAB systems are covered and terms such as tristimulus values, 2^0 and 10^0 observers, dominant wavelength, L, a, b values and total colour difference are explained.

The second section describes the manufacture and properties of a selection of important inorganic and organic pigments. In particular, a range of coloured organic pigments is dealt with in some detail, along with flow diagrams for the production of TiO_2, by two different methods.

In the third section the important area of pigment dispersion stability is studied. This is vital to avoid the process known as pigment flocculation. This is important during coatings manufacture, when a pigment millbase is to be converted into the finished paint and there is a danger of destabilisation of the dispersion.

The efficiency of pigment dispersion is described. This includes a general flow chart for manufacture. The relationship between dispersion efficiency and operating economics of a plant is explained. Finally, the efficiency of various types of dispersion machinery is described in terms of both dispersion time and labour requirements.

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Structure of the Module

The module training material consists of 4 sections, 1 Self-Assessment Questions (SAQ), 1 Computer Marked Assessment Questions (CMA), 1 Practical (PAX) and End Test (TMA).

This module is designed to take approx. 10 – 11 hours of study time. This excludes the time take to write up the report for the PAX.

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.

Practical Attendance Exercises (PAX)

Only a few modules contain PAX. However, we recommend that when starting any module, you look at the requirements for a PAX, to see if you anticipate any problems in carrying this out. For example, apparatus, materials, laboratory space and time. This PAX is concerned with assessing colour difference between pairs of coloured chips and is fully described in Appendix 2 of the Module. If you have any problems, please contact your tutor or workplace mentor for alternatives.

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.

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Marks for the module

CMA	20%
PAX	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 301, 302, 313 and 323 are very relevant. 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.

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 do the following

Section 1 – Colour description and measurement

1.1 Illustrate by means of a diagram the three parameters by which a colour is defined in the Munsell Colour Order System
1.2 Explain what is meant by Tristimulus values of a colour
1.3 Explain the use of 2^0 and 10^0 observer
1.4 Describe dominant wavelength and purity in CIE terminology
1.5 Demonstrate CIELAB colour space by means of a simple diagram
1.6 Calculate "total colour difference", Δ E, from given L, a, b values, for a pair of samples

Section 2 – The production of a number of selected pigments

2.1 Describe the production process for red iron oxide
2.2 Describe the production process for barytes
2.3 Describe the production process for phthalocyanine blue
2.4 Describe the production process for azo pigments
2.5 Given a partially complete flow chart for the titanium dioxide by either the sulphate or the chloride methods, label the missing processes and describe their role in the overall system

Section 3 – Effective stabilisation and "let down" of a pigment dispersion

3.1 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
3.2 Describe the theoretical and practical conditions required for the effective let down of a pigment dispersion

Section 4 - The efficiency of pigment dispersion

4.1 Given a partially complete flow chart of the process of paint manufacture, label the missing steps and explain their function

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4.2 Explain how dispersion efficiency affects the operating economics of the plant

4.3 Given a list of types of dispersion equipment, classify each as high, medium or low in terms of:

(1) Time efficiency

(2) Labour efficiency

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