

Level 3 Modules: Intermediate

Module Title & Description	Module	Average Completion Time (Hrs)	BCF Member*	Non - Member*
<p>Types and Manufacture of Pigments</p> <p>This module starts by describing and classifying various pigments and extenders used in the Coatings Industry, both by type and by physical form. The importance of pigment particle shape is presented and examples given of pigments and extenders which fall into these various categories.</p> <p>The Module goes on to describe the various parts in the pigment manufacturing process, including pigment after treatments. Pigment grinding, classification, filtering, drying and calcining are covered, along with pigment flushing and micronising.</p> <p>Next, the chemical composition and properties of a number of commonly available white pigments and extenders, are described in some detail, followed by similar sections devoted to the chemical structure and physical properties of some widely used coloured inorganic and organic pigments.</p> <p>Finally, the main properties of some widely used metallic pigments are summarised.</p>	301	7	£305	£415
<p>Properties of Pigments</p> <p>This module is concerned overall with the properties of pigments.</p> <p>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.</p> <p>Section 2 is dedicated to the optical properties of pigments, in particular, how pigments can affect the opacity and gloss of coatings.</p> <p>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.</p> <p>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.</p> <p>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.</p>	302	11	£305	£415
<p>Media: Thermoplastics Powders</p> <p>Thermoplastics are the foundation on which powder coating technology was built, and the coating technologist should be aware of the principles that govern their use.</p> <p>This module describes the types of thermoplastics available for coating applications, their important properties and their uses. The module also serves as a useful general introduction to the nature of polymeric materials.</p>	310	10	£305	£415
<p>Media: Thermosetting Powders</p> <p>Thermosetting coating powders have gained a sizeable foothold in the industrial coating field. As with any coating, the medium is the predominant factor determining performance.</p> <p>This module identifies the types of thermosetting media used in the formulation of coating powders, describing some of the basic chemistry involved. Details are given of the important properties which development chemists look for when selecting the component resins and hardeners.</p> <p>Included in the text are examples of typical raw materials and details of some of the principles involved in creating a coating medium. The module also introduces some of the more recent innovations in the field, which have been developed to improve features such as appearance and performance or to reduce curing temperatures.</p>	311	10	£305	£415
<p>Testing: Solvents and Resins</p> <p>This module deals with the testing of solvents and resins and is one of a series on the raw materials used in coatings. Earlier studies on raw materials include the foundation module 202, that discusses general properties of resins & solvents and intermediate level 303 that deals with the properties of solvents in some detail.</p> <p>Module 312 starts by defining solvents and their role in coatings and then explains different ways in which they may be classified. It then goes on to describe the characteristic properties of solvents and explains how their properties may be determined. A practical exercise is included which requires the student to determine the composition of a solvent mixture by measuring some of these properties.</p> <p>The second half of Module 312 reviews the classification of resin types used in coatings and their characteristic properties. It then proceeds to explain the general tests that are carried out to measure these properties. An outline of the polymerisation processes involved in the manufacture of resins is given and some of the tests carried out during manufacture explained.</p> <p>Finally, brief reference is made to properties of specific chemical types of resin and the effect of these properties on manufacture and coating performance.</p>	312	10	£305	£415

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<p>The Testing of Pigments</p> <p>Section 1 of this Module is concerned with the testing of a number of important pigment characteristics and properties, such as tinting strength, weathering resistance, resistance to light and heat etc. In Section 2 the importance of contrast ratio is described along with its determination. In Section 3 you are encouraged to compare and contrast the properties described in Section 1, for a wide range of pigments which are currently used in the coatings industry.</p>	313	10	£305	£415
<p>Manufacture: Paint</p> <p>This Intermediate Level module describes the technology and practice of paint manufacture. The basic stages of the manufacturing process are reviewed and the key roles of dispersion and stabilisation explained. The various types of dispersion mill used for paint manufacture are classified and the construction & operation of each class described. In the last section of the module, a manufacturing flow chart is examined and the efficiency & economics of the process is discussed. Module 314 is one of a series of modules at intermediate level. Following a successful completion of this module you may proceed to study further modules, selected on the basis of your needs. There are also a series of modules at Advanced Level that you may wish to study at a later date.</p>	314	15	£305	£415
<p>Manufacture: Ink</p> <p>This module describes the way in which different printing inks are manufactured and discusses the complex mixture of the raw materials that are blended together in a specific formulation to obtain the final properties required for different types of us printing application. Emphasis will be placed on the choice of grinding vehicle and the methods used to obtain effective pigment dispersion into the grinding vehicle concentrating on the different types of equipment available for producing liquid and paste inks. You will also be shown how to scale up a laboratory formulation and determine the best method of manufacture for that ink.</p>	315	10	£305	£415
<p>Manufacture: Powder Coatings</p> <p>Module 316 begins by giving an overview of the processes used in the manufacture of thermosetting and thermoplastic powder coatings and then proceeds to describe the nature of the raw materials used. Following this outline, a detailed description of each of the separate stages in the manufacturing process for thermosetting powders is provided. The theory of the dispersion process is examined and the mechanism explained together with a consideration of the extruders used. Grinding and classification are discussed and a description of the plant and processes used provided. In the final section specific processes used for the manufacture of some thermoplastic powder coatings are explained. A general consideration of the incorporation of pigments and metallic powders completes this study of powder coatings manufacture.</p>	316	12	£305	£415
<p>Evaluation of Paints: Physical Properties</p> <p>This module provides details and test procedures relating to the evaluation of paints once applied to 'standard' panels. Most of the tests will be carried out in the Paint Manufacturer's laboratory, although some customers may wish to confirm the property during production of their finished articles. A list of desirable physical properties is explained, with a discussion on how to prepare for and carry out suitable tests. The student will have an opportunity to carry out some of these.</p>	319	10	£305	£415
<p>Evaluation of Paints: Chemical and Environmental Properties</p> <p>This module provides details and test procedures relating to the evaluation of paints once applied to 'standard' panels. Most of the tests will be carried out in the Paint Manufacturer's laboratory, although some customers may wish to confirm the property during production of their finished articles. A list of desirable properties is explained, with a discussion on how to prepare for and carry out suitable tests. The student will have an opportunity to carry out some of these.</p>	320	10	£305	£415
<p>Evaluation of Coating Powders</p> <p>This module describes the methods commonly used to evaluate thermosetting coating powders, at all stages of development and processing. As the coatings industry has developed, it has been necessary to invent standard test procedures, in order to define and control the production, application and performance characteristics of our products. As a relatively recent addition to the coatings range, powders are still in a very innovative phase of their development. Accordingly, there are still many new questions that need to be answered. A cured film of powder coating is often indistinguishable from its liquid equivalent. However, in the powder form, the materials have certain features that demand closer and more specific scrutiny.</p>	322	10	£305	£415

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<p>The Evaluation Of Colour</p> <p>This module deals with a number of important aspects of the evaluation of colour. Section 1 is concerned with the main principles of colour. These include the illuminant, absorption and reflection of light and the workings of the eye, along with certain visual defects. Section 2 covers colour mixing and pigment selection. Here we look at both additive and subtractive mixing and important considerations to make when selecting pigments for coloured formulations. Finally, in Section 3, we deal with the important subject of colour measuring instruments. We look at various spectrophotometers and colorimeters and examine their use in quantifying important optical properties of coatings.</p>	323	9	£305	£415
<p>Paint Application: Spraying</p> <p>Some simple air-assisted methods are usually used in laboratory situations to try out new materials or on quality control of batches under manufacture. Similar equipment is used in small scale or specialist finishing operations, which are then sometimes used on automated situations. For those employed on customer service or sales of paint products the module will give a fuller understanding of the equipment used by potential customers. For customers, many of whom will have automated plants in order to cope with continuous line-production, there is added information about conveyerisation, potential problems, and an opportunity to evaluate or compare alternative methods.</p>	324	10	£305	£415
<p>Paint Application: Non-Spraying</p> <p>This module provides information on the various methods employed to apply liquid coatings, except spraying which is covered in 324. The main topic areas are dipping, including Electrophoretic, Roller coating, Coil coating, Curtain coating, Brushing, Hand rolling and Padding. Some simple application methods are usually used in laboratory situations to try out new materials or on quality control of batches under manufacture. Similar equipment is used in small scale or specialist finishing operations, which are then sometimes used on automated situations. For those employed on customer service or sales of paint products the module will give a fuller understanding of the equipment used by potential customers. For customers, many of whom will have automated plants in order to cope with continuous line-production, there is added information about conveyerisation, potential problems, and an opportunity to evaluate or compare alternative methods.</p>	325	10	£305	£415
<p>Ink Application Technology</p> <p>This module describes the common printing processes commercially used in the United Kingdom. It explains the general principles used to print both liquid and paste ink and discusses the key points of each printing process and the types of press configuration, which are available. It also explains the importance of plate technology and how different product applications need to be printed. This module concentrates on the specific processes of flexography, gravure, offset, lithography, screen and letterpress printing. Some consideration is given to historical methods, to better illustrate how some of the processes have evolved, and to give a clearer view of the physical processes involved. The module does not cover the ink-jet or toner-based technologies, or techniques such as intaglio relief printing, recess printing or collotype, which are rarely used, except for special purposes.</p>	326	10	£305	£415
<p>Application Equipment for the Application of Powder Coatings</p> <p>Module 327 contains a comprehensive study of the equipment used to apply powder coatings by electrostatic spraying, fluidised bed and a number of other less widely used application techniques. Although this module repeats some of the material in the foundation module 208 "Powder Coating Application & Cure", the main focus of this intermediate level module is on the equipment and methods used on the production line. Also 327 covers a wider range of application techniques. After reviewing the components and set up of powder coating application lines, the module proceeds with the equipment and methods employed for each application technique. The final section explains production control procedures including 'on-line' quality control. This section also discusses problems that may occur on a production line, the causes of these problems and possible solutions.</p>	327	10	£305	£415

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<p>Theory of Application of Powder Coatings</p> <p>Module 328 is concerned with the theory of applying powder coatings. It begins with a brief review of the background to electrostatics, how particles can be charged and the properties of these charged particles. It then goes on to introduce some of the phenomena that occur when applying powder coating by electrostatic spray, including self-limiting, back ionisation, faraday cage effect and overcoating. The next section deals with the theory of fluidisation of powder and how this influences the design and operation of fluidised bed systems. The design of articles to be coated by the fluidised bed method is included in this section, together with a discussion on the thermal properties of these articles. This section concludes with a review of a typical fluidised bed coating line. The third section is devoted to a more detailed study of the electrostatics involved in a powder coating spray installation. The accumulation of charge on powder particles, corona charging, tribo-charging, low voltage spray guns are all discussed together with some of the phenomena referred to briefly in section 1. The final section looks at tests that can be carried out to check and improve the efficiency of powder coating spray lines and some of the equipment available to perform these tests.</p>	328	11	£305	£415
<p>Application - Metallic Substrates</p> <p>Module 329 is an Intermediate module following on from the Foundation Module 206 on Surface Preparation. In Module 206 a study of the features of a surface and contaminants on the surface of a substrate was made. This was followed by a summary of methods of removal of the contaminants by mechanical means and a preliminary look at the processes where surfaces are cleaned chemically. In Module 329 the processes of chemically cleaning a metal surface and its subsequent chemical pretreatment will be considered in more detail. Following a review of Module 206 is a more detailed study of the plant used in degreasing including the vapour, liquid and spray baths, and a study of the advantages and disadvantages of the degreasing solvent, trichloroethene. Section 3 considers the cleaning of a metal surface by inorganic means, by treating the surface with acids and alkalis and the effect of this on the metal itself. The final section looks at the chemical basis for chemical pretreatment of metal surfaces, principally iron and aluminium. Phosphating and chromating in different situations and in different coating weights are considered. In addition, anodising as a technique is covered. The situations where each of these three applications are used concludes the module. Included in this section is a practical on phosphate pretreatment.</p>	329	11	£305	£415
<p>Application - Non-Metallic Substrates</p> <p>In Module 206, we considered the different types of substrates and explained the importance of cleaning surfaces before applying coatings and some of the techniques used to do so. This Module expands upon that basic information, concentrating on a wide variety of non-metallic substrates. We discuss the range of properties and how these affect the techniques available to us for surface preparation and application of coatings.</p>	330	9	£305	£415
<p>The Curing of Coatings</p> <p>This module is divided into three sections. Section 1 is concerned with the drying and curing of coatings by both stoving and radiation processes. Both box ovens and conveyerised forced draught ovens are described along with disposal of solvents and waste fumes. Finally in this section, the special requirements of powder coatings are presented. Section 2 is devoted to radiation curing, where particular emphasis is placed on IR curing, listing both advantages and disadvantages. The principles of UV and electron beam curing are described, along with the importance of oven siting in manufacture. Finally, in Section 3, the factors affecting choice of application and cure are discussed and practical examples given of the appropriateness of these considerations in practical situations.</p>	332	10	£305	£415
<p>Coatings - Safety, Health and Environmental Aspects</p> <p>On almost every surface we see there is some form of coating. They enhance the appearance of the finished article and they are essential for the protection of materials. However, the coatings are made of chemicals, many of which have adverse effects on human beings and on other living things. There are mechanical and electrical hazards involved in their manufacture and application and hazards due to flammability and toxicity of components in the coatings. There is the risk of pollution, should they escape to the outside environment. The law requires that the workplace be safe to work in and that a company does not put employees or others at risk. Lately, greater emphasis has been put on environmental issues, adding to the pressures on the coatings industry. Conservation of resources and pollution control must somehow be balanced against the need for economical and effective coatings. This module aims to provide a general awareness of the law and of the safety and environmental issues in our particular industry. Hopefully, it may whet the appetite of some readers enough for them to seek formal qualifications in the subject.</p>	333	10	£305	£415

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