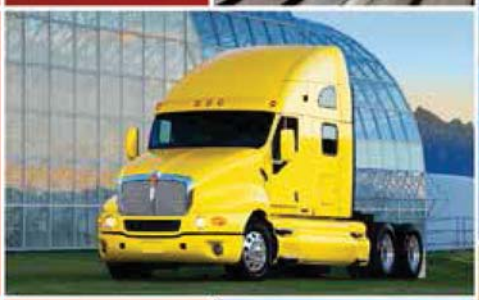
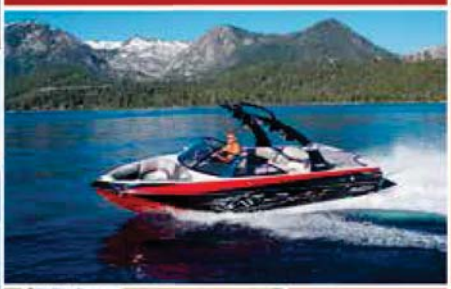
Open Molding

Study Guide

CERTIFIED CCT COMPOSITES TECHNICIAN





ACMA
American Composites Manufacturers Association

Open Molding

When you apply to become a Certified Composites Technician (CCT), you take the first step towards achieving excellence in the composites industry, advancing your career, and pursuing comprehensive open molding composites knowledge.

The CCT program is designed to elevate standards in the industry by enhancing individual performance and recognizing those who demonstrate critical knowledge of the composites industry. The CCT designation is a noted symbol of education among employers, employees, and industry professionals. As the industry advances, being a CCT will become increasingly important.

If you are committed to developing your career, attaining the CCT designation will allow others to recognize you as a certified composites industry professional. This Study Guide will cover the steps in becoming a CCT in Open Molding by providing you with critical knowledge and key concepts of the open molding process that will lay the foundation for your growth and understanding as you progress.

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Printed in the United States.

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SECTION 1

Introduction to Gel Coating Technology

Applying gel coat is one of the most critical aspects of composites production. When customers look at a product, their first impression is based on the appearance of the gel coat surface. In addition to its cosmetic qualities, gel coat is used to provide weather and chemical resistance to composite products. The gel coat applicator's job is to produce the best quality gel coat finish possible.

While the process of spraying gel coat appears relatively simple, exacting procedures are required to produce consistent defect-free finishes. This training module will highlight the proper procedures and methods to produce high-quality gel coat finishes. Once these procedures and methods are understood, many hours of hands-on training will be necessary to develop the skills of a qualified gel coater.

There are three critical components to the gel coating process: the gel coat, the spray equipment and the method of application. These elements must all function properly in order to produce a quality product. Remember, even if the procedure is 90% correct, the result will probably be a rejected part. Success in gel coating means getting the procedures 100% correct, 100% of the time.

What Is Gel Coat?

Gel coat is a specialized form of polyester or vinyl ester resin that is formulated as an in-mold coating. This in-mold coating becomes the cosmetic outer surface of the final molded part. Gel coat consists of: a base resin, additives to create non-sag properties, inert mineral fillers, and pigments to provide coloration. There are also additives to enhance the stability of the gel coat and to promote the cure. An initiator is added during the application to cure the gel coat film.

Gel coats are designed to cure in a thin film and are typically sprayed in wet film thickness of between .016" and .024". This is expressed as 16 to 24 thousandths of an inch. Another way of expressing gel coat thickness is in mils. When using mils to express applied gel coat thickness, a thickness of 16 mils to 24 mils is the same as 16 to 24 thousandths of an inch.

Gel coat is normally designed to be sprayed on a mold surface with the laminate then applied over the gel coat film. Since the applied thickness of this in-mold coating is very important, spray application provides the best means of controlling the film thickness.

Why Is the Application of Gel Coat so Important?

The performance of the gel coat surface on a finished product is closely tied to how the material is applied. For example, gel coat that is too thick may be prone to cracking, while gel coat that is too thin may not cure properly. If gel coat is over-initiated or under-initiated, curing problems may result which can affect the color and durability of the finished product. In short, the quality of the finished product is closely tied to the quality of the gel coat application.

Another factor closely tied to application method is styrene emissions during the spraying process. The way the spray gun is set up (pressure, tip size), and the operator's spraying technique, has a great influence on the amount of styrene emissions produced during application. Minimizing overspray is a major factor in reducing styrene emissions, maintaining a clean work area, and reducing material waste. (Guidelines for proper controlled spraying will be covered in Module 3-Controlled Spraying.)

Basic Gel Coat Chemistry

Most gel coats are based on a polyester resin. Polyester resins are made by reacting an acid with an alcohol in a process called condensation polymerization. This forms a group of molecules known as an *ester*. The word *poly* means *many* - so polyester literally means *many esters*. Chains of repeating ester molecules are called a *polymer. Styrene monomer* is added to the polyester polymer forming what is known as an unsaturated polyester resin.

The process of curing a polyester resin is known as *crosslinking*. During the curing reaction, the styrene molecules crosslink with the polyester polymer, causing the resin to convert from a liquid to a solid. The addition of an initiator (sometimes incorrectly called a catalyst) moves the reaction forward, causing the styrene molecules to bond with the polyester polymer in the crosslinking reaction.

During the crosslinking reaction, heat is generated. This heat is known as *exotherm.* The exotherm temperature of a curing gel coat is affected by the thickness or the mass of the gel coat. A thin film of gel coat will generate less exotherm and cure slower than the same amount of gel coat concentrated in a cup. In a concentrated mass, gel coat will cure quickly and develop a very high exotherm.

The speed of the crosslinking reaction (gel coat cure) is affected by the formulation of the gel coat, the temperature of the gel coat, and the amount of initiator that is used. The term *gel time* is used to measure the speed of the reaction. Gel time is the interval from when the initiator is added to when the material transforms from a liquid to a gel in the sample cup. Typically 100 grams of gel coat in a cup will be used to determine gel time.

The crosslinking reaction is highly dependent on temperature and the amount of initiator used. The temperatures of the gel coat, the mold, and the air also have an effect on the rate of cure and the properties of the finished gel coat. The percentage of initiator mixed with the gel coat is a major influence on the speed of curing and the quality of the finished product.

Gel coat manufacturers have a specified working temperature range and an acceptable range for the percentage of initiator for each gel coat. These specifications are based on the chemistry of the product, and the ranges should not be exceeded if the proper cure is expected.

SECTION 2

Gel Coating Safety

Gel coat can be handled safely on a day-to-day basis if the proper procedures are followed. It should be noted however, that polyester resins and gel coats present several *potential* hazards if they are misused or handled improperly.

The Material Safety Data Sheet (MSDS), which accompanies each shipment of gel coat and is on file with the company, provides detailed requirements for the safe handling of each specific gel coat. The MSDS is the official source for information on all the chemicals that a person may work with or be exposed to during work. Questions concerning proper handling precautions, required personal protection equipment, or hazardous ingredients of a product, should be answered by referring to the MSDS. The potential hazards of gel coat fall into several categories:

- Toxic Hazards
- Spray Equipment Hazards
- Fire Hazards
- Spill Hazards

