



## Solvent Rub Testing Powder Coatings for Cure

### INTRODUCTION

The full cure of a powder film has a big impact on film performance. Full cure is achieved when the powder has been exposed to adequate thermal energy for the required amount of time.

The oven used for curing powder can be measured to determine what level of temperature was achieved and how long the part was exposed to the needed cross-link threshold. If a temperature recording device shows that the specified time and temperature was met it is assumed that the powder has reached full cure. However, it is still important to have a method of measuring and determining that the film is fully cured to ensure full performance.

Methods of testing for cure may include film properties or lab tests such as Differential Scanning Colorimetry (DSC). The options and methods for testing for cure are listed below.

### FILM PROPERTIES

A Technical Data Sheet (TDS) is a description that is created by the powder supplier to show the expected level of performance that the film can achieve. If the finished film can achieve the level of performance described in all categories it is an indication that the film is cured. Some of the performance attributes are visual (gloss, color) and can be measured quickly without harming the film. Others take time and will cause damage to the film (adhesion, salt spray).

Short-term visual tests can be useful to immediately identify the level of cure. They cannot confirm cure but they can serve as a guideline.

Color and Gloss – observation and measurement of color and gloss can show if the powder matches the numerical values described in the powder material specification. If the color is not right or it is inconsistent it may indicate a cure problem. If the gloss is too high it may indicate under-cure or if it is too high it may indicate over-cure. The color and gloss are not absolute tests of cure but they can be early indicators of a cure problem.

Other short-term tests that require the destruction of the film can be more reliable as a cure measurement. Pencil hardness, flexibility, adhesion, and solvent resistance should be consistent and meet the minimum performance indicated on the TDS. They can be performed on actual parts or on samples that are the same gauge as the parts.

Solvent resistance is a common test used to measure the degree of cure. While it is truly a test of solvent resistance and rather than a cure test it can be performed using a precise process and give reliable results for cure.





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### TESTING PROCEDURE

The solvent cure test has been devised to differentiate between cured, partially cured, and uncured thermoset powder coating products.

First, it must be understood that the degree of chemical resistance of a particular powder being tested is a factor in the test results. Therefore, it is critical that the tested film be compared to a known cured sample to confirm the results. The known cured sample can be supplied and confirmed by the powder material manufacturer

This method describes two potential solvents that can be used for the determination of cure in powder coatings:

1. For epoxy powder coatings, or other powder coatings which exhibit a high degree of solvent resistance a strong solvent such as Methyl Ethyl Ketone (MEK) is recommended.
2. For other powder coatings such as hybrids (epoxy/polyesters), polyester urethanes, TGIC (triglycidyl isocyanurate) cured polyesters, etc. that may have lower solvent resistance a blend of MEK and xylene or acetone in a suitable ratio (typically 50/50) is recommended. This solution can be tailored to more clearly define "cure" in a particular powder coating formulation by either increasing or decreasing the concentration of MEK in the solvent blend, or using different methods or blends of solvents.

### MATERIALS

- ◇ Solvents: MEK (Methyl ethyl ketone) or solvent blend to be determined based on specific powder. Container (squeeze bottle) to hold mixed or single solvent.
- ◇ A standard cotton swab.
- ◇ Coated article at a specified thickness.

### PROCEDURE

Saturate swab end with appropriate solvent or blend. It is recommended to re-saturate the pad after 50 double rubs. A double rub is one stroke forward and one stroke back in approximately one second. The proper stroke is approximately 1" long.

Be sure to do this in an area with adequate ventilation, consistent with accepted lab practice, to prevent solvent vapors from accumulating.



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### RESULTS

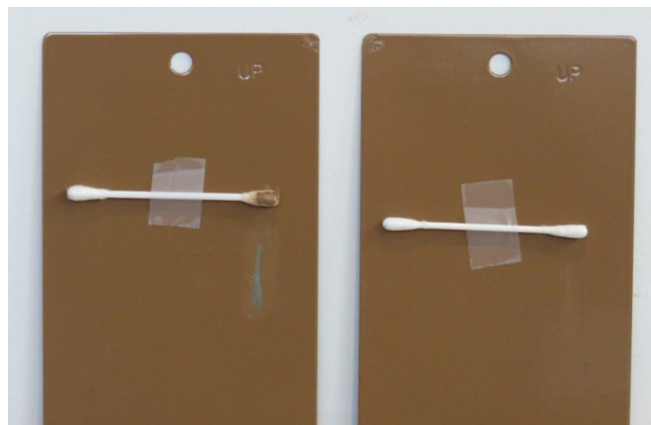
Results from this test should always be compared with known cured panels representing the same system under evaluation. Without the known cured panel the test is a solvent resistance test, not a cure test.

Results are measured in the degree of powder removal from the test area.

- No Cure: Powder removed to bare metal
- Partial or Full Cure: Some film removal and softening (compare to known sample)
- Cured Coating: No effect on film appearance or gloss

### IMAGES

#### Low Cure



Test Panel

Known Cured Panel

#### Partial Cure



Test Panel

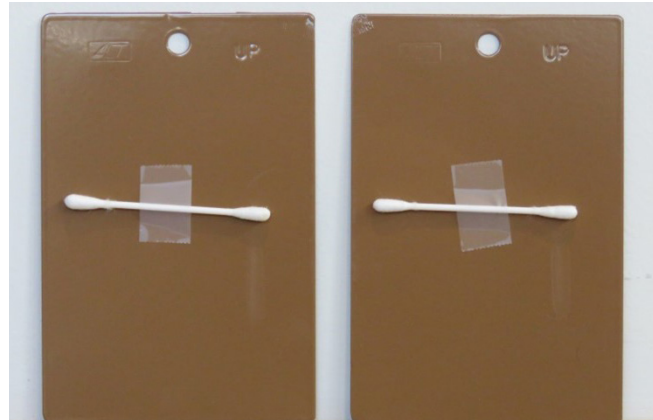
Known Cured Panel

# TEST METHOD: VCTM20211



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### Full Cure



Test Panel

Known Cured Panel

### PRECAUTIONS

Be sure to use the appropriate Personal Protection Equipment (PPE). Typically, this means you should be wearing gloves and safety glasses and performing the test in a well-ventilated area.

Be aware of hazards using solvent(s) (consult MSDS or supplier Technical Data Sheets for proper handling procedures and protect against skin or breathing exposure and stay away from ignition sources).

### CONTRIBUTORS

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