

Coatings Consultants Inc.

Telephone 561-775-7151

A consulting firm specializing in:
Testing of Paints & Coatings
Quality Assurance Inspections
Specification Writing
Failure Analysis
www.coatingsconsultants.com

8211 Needles Drive, Palm Beach Gardens, Florida 33418

IT'S IMPORTANT TO CONSIDER MOISTURE BEFORE APPLYING PAINT

By Bob Cusumano

Water is a compound that is necessary to sustain animal life. However, to a painting contractor, considering substrate moisture is of foremost importance to the life of an applied coating system. It doesn't matter if the substrate is wood, concrete, stucco, concrete block or metal, it is important that the amount of moisture present be measured and accommodated.

Paint delamination and rot (photo 1) often result when wood contains a high level of moisture. The source of the moisture can be generated from within the building when a vapor retarder is not present or can enter from cracks and voids on the exterior. On wood, a two pin moisture meter such as that shown in photo 2 is often used. The pins are inserted into the wood and the moisture level is indicated on the meter. Photo 3 shows that the meter contains two scales, the top one is for wood where it shows green or good for moisture levels below 15%, yellow or questionable for 15% to 17%, and red or not recommended for moisture levels above 17%.



Photo 1



Photo 2



Photo 3



Photo 4

A second type of moisture meter is shown in photo 4. These moisture meters are termed electrical impedance type. They operate by transmitting a low-frequency electrical signal from one electrode fitted at the base of the instrument which is put in contact with the surface being tested. A second electrode, also at the base of the instrument, acts as a receiver. When there is no moisture present in the material under test, very little current flows between the electrodes and no reading is recorded. When moisture is present, the current flowing through the material under test is dramatically increased and gives an increased reading on the meter display. The greater the moisture content, the higher the reading for a given sensitivity setting. The advantage of this type of meter is that it can detect moisture beneath the surface.

There are a variety of coatings failures that can be caused by moisture in conjunction with cementitious surfaces including concrete, stucco, and concrete block. All cementitious materials have alkali present. When moisture migrates through the cementitious material, alkali salts concentrate immediately beneath the paint film. This condition results in a degradation of the resin and/or pigment in the paint film and occurs when the paint is in contact with an alkaline substrate. Alkali burn occurs when the resin and/or pigment in the paint degrade and "bleach out". The area immediately adjacent to any cracks is often unaffected because the moisture can easily escape through the crack rather than migrate through the stucco. This is the cause of the spider web appearance shown in photo 5.

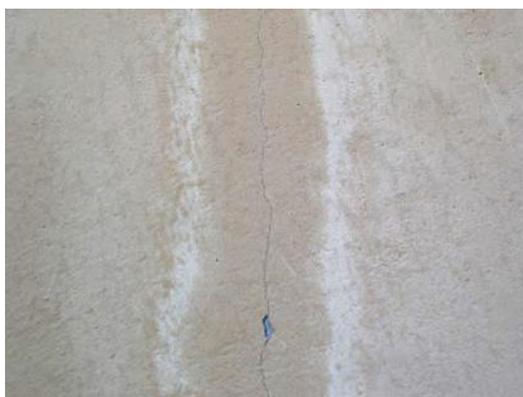


Photo 5



Photo 6

Efflorescence is the formation of crystalline salt deposits, usually white, on a surface due to the migration of water through a cementitious substrate. The vertical rundown pattern obvious in photo 6 is typical of this condition. When the affected paint film is very permeable, or when voids exist in the coating film, then the occurrence of efflorescence does not cause delamination of the paint.

Saponification is the chemical degradation of a coating due to high alkalinity and moisture. The coating becomes "sticky", then brittle when dried and loses its adhesion. This catastrophic failure of the coating is a result of water migration and is shown in photo 7.



Photo 7



Photo 8

The two pin moisture meter shown in photo 2 is one method of measuring moisture in cementitious surfaces. In this instance the lower plaster/concrete scale is used. Note that green or good is indicated for moisture levels below 80%, yellow or questionable for 80% to 86%, and red or not recommended for moisture levels above 86%.

ASTM Standard D4263 describes a test for indicating moisture in concrete. A sheet of plastic approximately 18 inches square is tightly taped to the concrete surface so that the edges are totally sealed. After in place at least sixteen hours, the plastic is removed and the area under it is examined for moisture. This test can be performed on either horizontal or vertical surfaces and is shown in photo 8.

A test method for measuring moisture that is appropriate only on horizontal concrete, particularly floors, is described in ASTM F-1869-04. This method quantifies the moisture emission rate. A canister containing calcium chloride is accurately weighed. The canister is then opened and placed on the bare concrete. A plastic dome is placed over the canister and sealed at its perimeter with a special putty. A dome test is shown in photo 9. After three days' exposure, the dome is removed and re-weighed. The moisture emission rate of the concrete in each test is then calculated using the weight gain of the canister. This method quantifies the moisture emission rate of the concrete which can then be compared to the permeability of the coating system to be applied. If the specified coating system can accommodate the moisture emission of the concrete,

it can be successfully applied. If the moisture emission rate is higher than the rating of the specified coatings system, then alternate materials must be selected.



Photo 9



Photo 10

When painting metal surfaces, it is recommended that the surface temperature of the metal be at least five degrees higher than the dew point. The dew point is the temperature at which moisture will condense on the surface. By knowing both the ambient air temperature and the relative humidity, a dew point chart will indicate the dew point temperature. A simple device that will provide both the ambient temperature and the relative humidity is a sling psychrometer shown in photo 10. A sling psychrometer has two thermometers: a wet bulb and a dry bulb. The wet bulb has a cotton wick over the bulb of the thermometer, which is moistened with room temperature water. The dry bulb is simply a thermometer. Both are attached to a dowel with a screw so that they may be spun through the air. A sling psychrometer works on the premise that evaporation is a cooling process. The drier the air, the more evaporation takes place off of the wet bulb, dropping the temperature on the thermometer. After you are finished swinging the psychrometer, the dry bulb and wet bulb temperatures are used on the device to indicate the relative humidity and the ambient air temperature is indicated on the dry bulb. A temperature gun, such as that shown in photo 11, can be used to measure the surface temperature.



Photo 11

Successful jobs by knowing how to test surfaces for the presence of moisture is the goal of every painting and decorating contractor. Like the old adage "measure twice before you cut" in carpentry, your motto should be "measure the moisture before you paint".