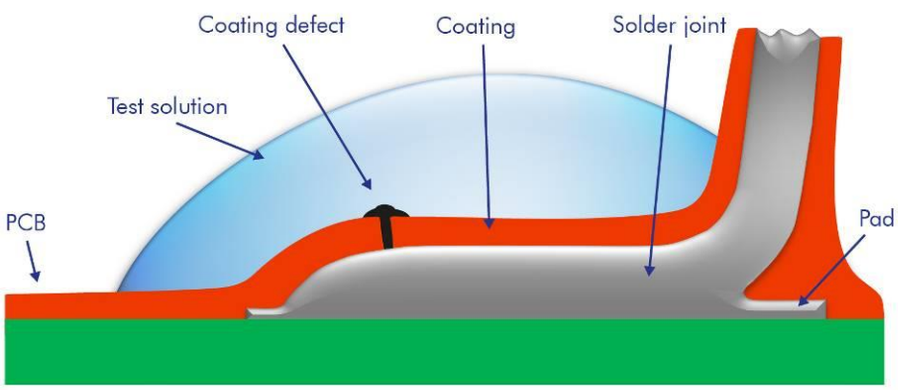
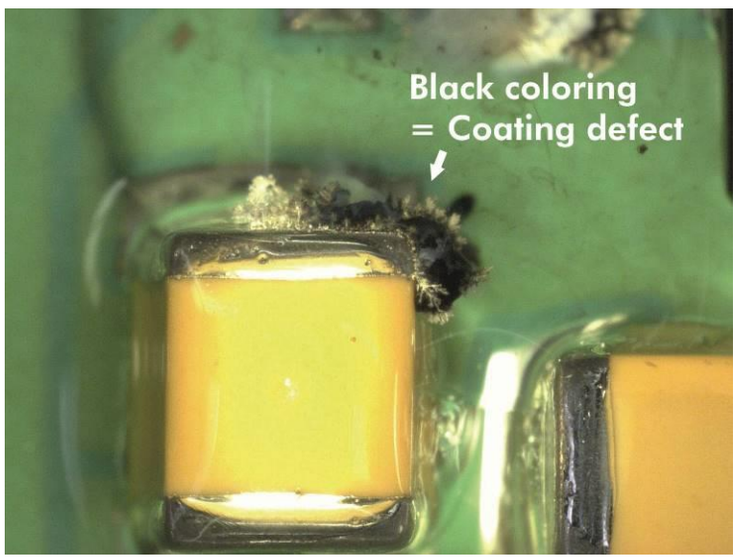
1. ZESTRON® Coating Layer Test area of application

The reliability of protective PCB assembly coatings with regard to climate and harmful gas safety is essentially determined by the absence of surface contamination beneath the coating and the closeness of the coating to the board's surface. Poor edge covering of contacts and pore channels that form in coating pooling areas have damaging effects.
In the case of fluorescently adjusted protective coatings, on the shoulders of the contacts of SO and QFP housings or on the solder joints of 2-polars, the evidence of a closed and thus protective coating layer is difficult. The ZESTRON® Coating Layer Test detects these mostly very thin, often (black) light optically difficult to unrecognizable films safely.

Using a black coloration indicator, the ZESTRON® Coating Layer Test highligts defects in protective coatings or non-closed layers even in so-called µ-coatings. The test thus adds the standardized methods for coating thickness measurement by enabling rapid detection of closed and dense coatings. Therefore, the test can also be used during production for cost-effective sampling.



Schematic illustration of a defect



Real defect

Background

Electronic assemblies are usually covered with an organic, protective conformal coating. The protective coatings are designed to protect metallic areas such as component contacts or test pads against harmful environmental influences that possibly cause corrosion. Protective coatings are also used to isolate the conductors against the environment. Some coatings are hydrophobic (µ-coatings) based on perfluoro compounds with layer thicknesses between 1 – 3 µm.

In order to ensure protection against the harmful climatic environmental influences, the organic coating must completely cover the metallic areas of the electronic components, the electrical conductor paths, and metallic pads. Any defects in the coating layer will reduce the protective efficacy of the conformal coating.

Defects can occur due to an absent edge covering, contamination of the coating material or coated surface, errors during the application process, or mechanical influences after application.

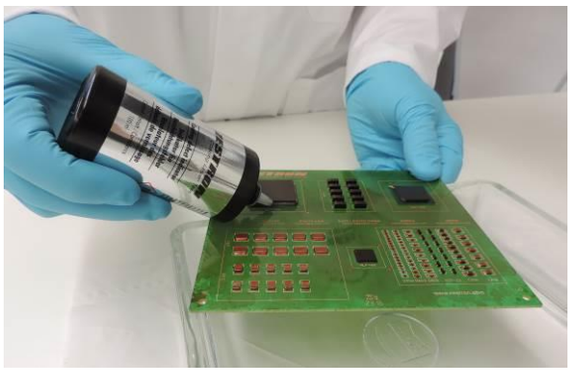
Previous error testing methods consisted of intense visual scrutiny of fluorescent coatings with black light, environmental simulation tests, or the Coating Reliability (CoRe) test according to GfKORR (Society for Corrosion Protection; Guidelines for Application and Processing of Protective Coatings for Electronic Assemblies).

2. Special Remarks / Disposal

- The ZESTRON® Coating Layer Test must not be discharged into the wastewater, but must be collected and discharged separately as heavy metal waste, (i.e. together with solder paste or solder paste-containing wipes).
- The ZESTRON® Coating Layer Test is intended to be used only on surfaces that are coated with a protective coating, unless it is being used as a solderability test.
- Only originally sealed ZESTRON® Coating Layer Test kits and bottles will guarantee reliable test results.
- The ZESTRON® Coating Layer Test should be stored in a refrigerator at a temperature between 5-10°C / 41-50°F. The product has a minimum shelf life of 1 year, when stored at the recommended temperature.
- Assemblies where a black coloring occur indicate incomplete conformal coating and should no longer be used. The test is destructive in case of a defect detection.

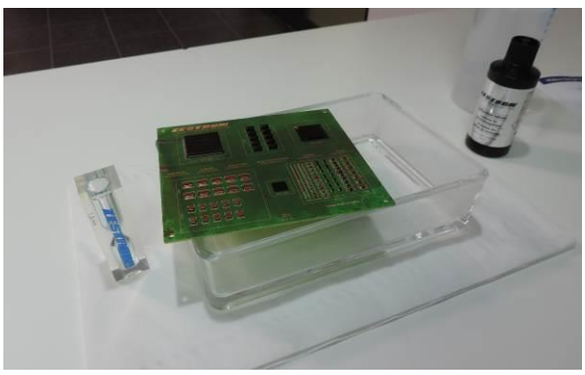
3. Conducting the Test

1. Application on the electronic assembly



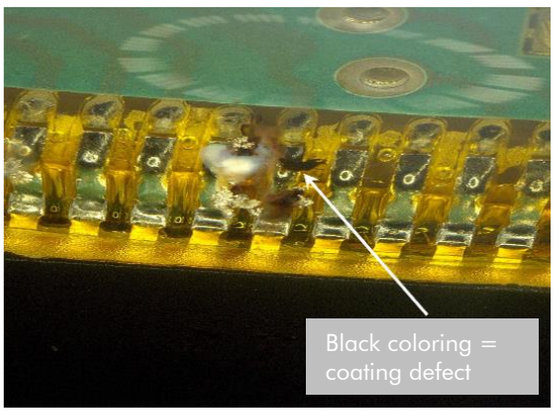
- **Wear protective gloves, goggles and laboratory coat!**
- Apply the ZESTRON® Coating Layer Test indicator selectively or over a large area of the coated PCB.

2. Wait



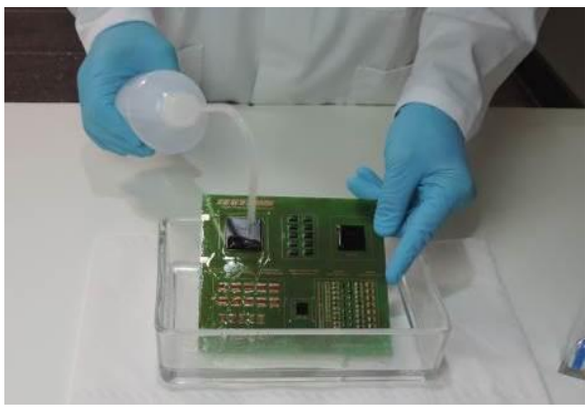
- Allow the indicator to react for max. 3 minutes. Use the timer (turn 2 times).
- If blackening of the board appears after only a few seconds, this may indicate large defects in the coating. You may disregard the time remaining and begin interpreting your results as soon as this becomes visible.

3. Interpretation

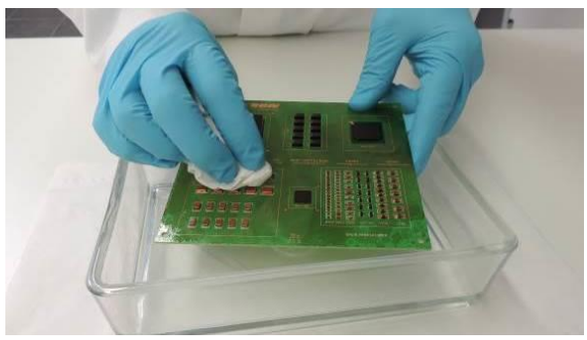


- Perform test evaluation for defects in the coating.

4. Rinsing and Drying



- Rinse thoroughly with distilled or DI-water. It is recommended to conduct the test over a laboratory dish and to wipe off the dish with a paper cloth. Alternatively, you can dab the PCB with a paper cloth.
- Please observe the disposal instructions for the indicator.
- Allow the PCB to dry. Drying times can be reduced by using compressed air (use only dry and oil free air).



4. Assessment of the Test Results

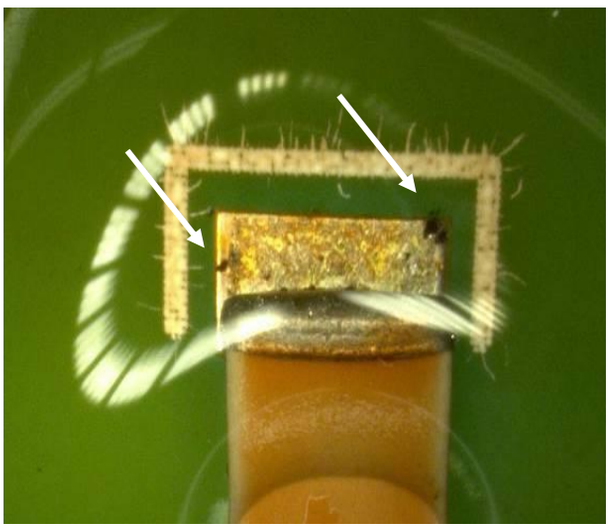
4.1 What is colored?

The aqueous clear test solution reacts by forming a black sediment on defects in the protective coating, meaning areas not covered with a protective lacquer, µ-coating or likewise. The reacting metal surfaces indicated by the black coloration may be tin, copper, nickel, nickel compounds or other less noble metals such as ferrites (Fe, Fe / NiZn, Fe / Mn).

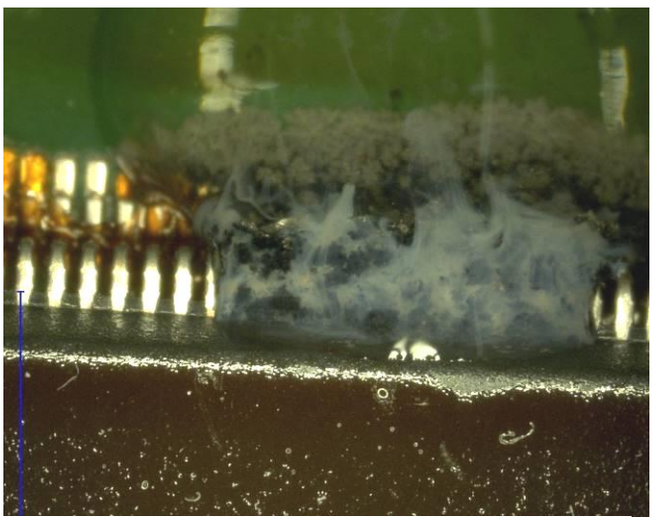
4.2 Intensity and distribution of discoloration

If no blackening is found on the entire surface of the coating that has been tested, there is no indication moisture has direct access to the assembly surface and thus no increased risk of attack by corrosion or electrochemical migration. You can assume a failure-free coating.

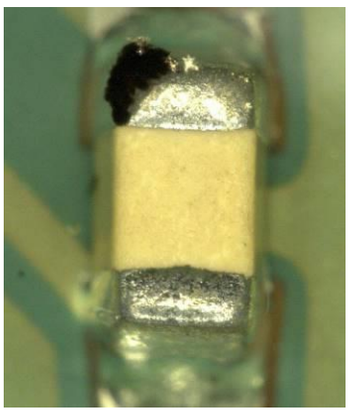
If blackening occurs, the intensity - latest evaluated after max. 3 minutes - gives an indication of the defect size. The distribution of the black color gives a first indication of the defect geometry. In particular, larger areas of non-given edge coverings, cracks and pore channels can be distinguished.



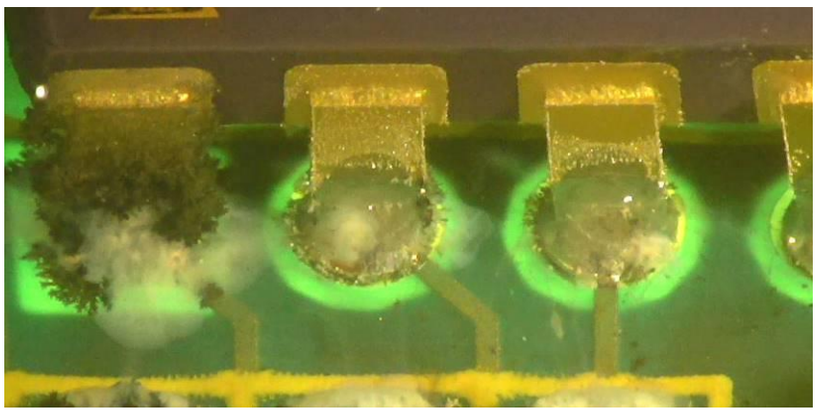
Defects in the coating due to flux residues on connection pad of a ceramic capacitor



Non-closed coating layer at the connectors of a QFP, high intensity and size of the defect



Poor edge covering at a ceramic capacitor



Defect at connection contacts: on the left a stronger reaction is visible, on the right the reaction is weaker

4.3 When should the black reaction be considered critical?

Large black reaction, assessed after max. 3 minutes, should always be considered critical. These metallic areas are exposed to moisture and corrosive gas, which can lead to corrosion or electrochemical migration. A disproportionate reduction of the isolation resistance is expected.

The risk potential of a small area reacting depends on the sensitivity of the affected components and areas. Defects found in the following areas should be considered significant problems invalidating the use of the board: between power supply conductors (VCC) and grounding conductors (GND), between measuring bridge resistors or other high-resistance areas, especially in active components with high input impedances, back-up capacitors, and between piezoelectric crystal contacts.

To fully evaluate risk, the climatic conditions and the circuit design must also be considered.

4.4 What else needs to be checked?

In the absence of discoloration, the conformal coating has completely covered the board. This is a necessary condition for a sufficient protective effect. The adhesion of the layer to the substrate, absence of flux or resin residues on the surface, the degree of curing, etc. are necessary for a reliable protective effect, too.

For this reason, the climatic conditions of use in comparison to the circuit design must also be considered or tested in an attempt to assess the risk.

If defects are found, the coating was not successfully applied and metallic areas will be exposed to the environment. Since poor or non-continuous covering might have occurred, the electronic assembly may be rejected as insufficient. The coating process should be optimized accordingly.

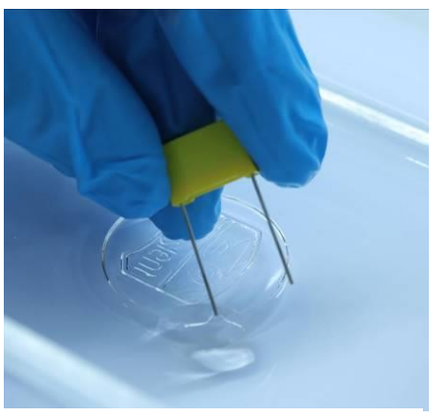
If you have questions regarding the interpretation of the results or if you need help with the risk assessment of your assembly, please contact ZESTRON directly.

5. Additional application: solderability test for components

The indicator liquid can also be used to check the readiness for solderability of components prior to soldering.

When the contact point is immersed in the test liquid, a black colour reaction occurs when the wetting ability is present. In this case, a clean and good quality metallization on the component can be assumed and the components can be used in production. The black colour has no negative effect on the solder joint.

If there is no visible colour reaction the intermetallic phase has grown through the surface making it more difficult to form a connection with the solder. This is especially common with chemical tin, and can result in weak solder connections, which can lead to PCB assembly field failure.



Immersing a THT connector in the test fluid

Black coloring = good solderability

Above: Reaction with test (good solderability)
Below: No reaction with test (bad solderability)