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TEST & CALIBRATION INSTRUMENTS

Case Story

Testing Weather Conditions on Coatings - in the Lab

The worst-case scenario for an exterior paint coating is early failure when at the mercy of demanding environmental conditions. Whilst companies can test samples in challenging climates over the long term, it is possible to approach the problem within a shorter time scale by studying product behaviour under simulated conditions in the laboratory. Materials characterisation specialists at Exeter Advanced Technologies (X-AT) are doing exactly this by examining the effects of environmental conditions on the mechanical properties of standard coil coatings from Becker Industrial Coatings (BIC).

Coil coatings are used to protect internal and external building cladding, domestic appliance carcasses, automotive body panels and many other industrial end uses. Buildings can be exposed to any number of environmental conditions such as: extremes of heat and cold, high and low humidities and those promoting corrosion. The last scenario occurs especially close to coastlines.

Therefore, the exterior paints must be resistant to corrosion, possess colour stability when exposed to strong UV light and have good durability, which includes resistance to paint delamination. Dirt pick up resistance is another major requirement for exterior coatings. For use on domestic appliances, the paint needs to be resistant to knocks and stains, and have the ability to bend smoothly into shape without cracking.

Challenge

To fully understand the behaviour of external coatings wherever in the world they are exposed, whatever the climate, ideally the paints need to be tested and examined in location. However, this is not always possible, so obtaining good quality information on the behaviour under a given set of circumstances is critical.

Beckers was particularly concerned with understanding the effects that extreme environmental conditions have on its products, particularly coil coatings. They decided that this could be achieved by supporting a university to develop an environmental control chamber that could be placed around samples situated in a tensile testing machine. For such specialists expertise and equipment, the company looked to Exeter Advanced Technologies (X-AT), to come up with a solution.

Solution

The laboratory at X-AT is equipped with various materials characterisation equipment such as the EZ20 universal testing machine from Lloyd Instruments. As well as boasting a powerful 20kN force capacity, this machine also features a 1000Hz data sampling rate for unrivalled sensitivity to test thin paint film samples that BIC require.
Furthermore, the robust twin column frame means accuracy is not compromised when used in conjunction with the company's own thermal cabinets and environment chambers. It is therefore possible to carry out tensile to break tests on thin film coatings at precisely controlled humidity and temperatures ranging from -30 to +60ºC.

By adapting the environment chambers and thermal cabinet attachments, X-AT was able to replicate accurately the environment conditions that the final end users are faced with.
The effects of humidity and liquid immersion on the physical properties of the system could be predicted so that adjustments could be made prior to exposure in extreme conditions of humidity, temperature, UV dose and atmospheric contamination.

To simulate different humidity conditions as well as changing temperature conditions, samples were also placed within a specially designed humidity chamber, which in turn was fitted inside the thermal cabinet. In addition, an oven was designed to be filled with water to simulate wet conditions.

Using a special immersion jug, samples were tested in tension under water. X-AT used Lloyd Instruments' powerful NEXYGEN*Plus* software to control the EZ20. Fully Windows compatible, this flexible software package possessed a huge library of international standard test set-ups for manufacturing compliance.

To test coil coatings, two types of tests was performed: a tensile test and a peel test. Tensile samples only 30 microns in length were prepared by coating a non-stick surface, curing in the normal way, removing the sample and using specially designed tensile grips to clamp the sample. Tests performed included tensile to break and creep tests under controlled load. The tests were repeated under different environmental conditions and data was stored and analysed using the standard tensile test set-ups within the NEXYGEN*Plus* software.

LLOYD materials testing