HELLESPONT
Mariners with a Mission

Paint Fingerprinting for Quality Control

In ship building one of the most difficult jobs is to get the painting of the ship right. The different tasks are:monitoring temperature and humidity, ensuring low salt contamination, controlling the film thickness, and timing correct inter-coat intervals. And all this effort is useless if the paint is made incorrectly in the first place.

If the paint was made incorrectly at the factory, sat too long in the warehouse, or was contaminated somewhere on the journey from factory, to warehouse, to mixing at the painting site, then the coating will not perform as it should, will fail rapidly, and have too short a lifetime. This is why paint companies test their products continually to ensure that their paints - when applied correctly - will meet their performance specification and guarantees.

Due to the fact, that it is so important to get the quality of the paint right, Hellespont decided to make reference fingerprints using known good paint samples from the maker. It would then take fingerprints in the shipyard from all batches and reject those batches (and their work product) whose fingerprints did not match their reference.

In 2001 Hellespont began working wit h the National Chemistry and Physics Laboratory of Greece (EIE) to customize the science and mathematics of chemiometrics to marine paint. After study it was determined that the paint's Near Infrared (4000-10000 nm) spectrum would give the most robust characterization (the fingerprint) of the paint. Hellespont bought such a Near IR spectrum analyzer and moves it as needed to each project – we are now on our third project with the same machine.

While the underlying methodology is now well developed for our marine paints (two makers and several types of paint) we have to study and specialize the fingerprint for each grade in order to determine the best fingerprint that will detect paint formulation mistakes over the maker's expected range of raw materials. Hellespont continues its collaboration with EIE and paint makers.

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example two spectral peaks may always be present at the same wavelengths with the same relative amplitudes (e.g. peak 2 is half peak 1). Many of these spectral peaks and valleys are determined along with their expected variation (e.g. peak 2 is 35-65% of peak 1). This becomes the reference fingerprint - a description of relative spectral peaks and valleys at various wavelengths along with acceptable deviations.
At the building site aluminum foil sample sheets are sprayed with the actual paint just prior to the paint's application on the steel. These samples are then dried and the site team's spectrum analyzer takes the samples spectrum. The fingerprint is extracted from the spectrum and compared against the reference. If there are too many values/peaks that are outside the expected variation or by too much then the software gives a NO GO warning.

The sample is repeated and if the NO GO is still given then the paint is rejected. The Laboratory is emailed the spectrum for technical comment (often they can pinpoint the cause, e.g. talc powder was "forgotten"). Then after investigation the paint maker will arrange and make the necessary corrective action.

The catch is the cost of a suitable field spectrum analyser; the chemiometrics consulting time is about US$45,000. If one has samples ready to go, then it takes 5 days to develop the reference spectra, another 5 days over the first 100 or so field samples, and then an occasional consultation - depending on the samples. We found the cost to be about the same as the time for one foreign ship's paint inspector wages. The typical total paint material cost is between US$400,000 to US$1,000,000 per ship.