Understanding Surface Profile - Elcometer

In the industrial and protective coatings industry, metal surfaces are blasted not only to remove corrosion or old coatings, but to generate a surface profile prior to re-painting. In some industries a surface profile is achieved through chemical etching or mechanical abrasion. But, regardless of the method, the surface profile increases the surface area of the metal - and it is this increased surface area which provides a key for the coating to adhere or stick to.

If you apply paint to a smooth, mirror finished piece of steel, you'll find it is very easy to scrape off – even with your finger nail. The same paint applied to a blasted piece of steel is another matter entirely.

Imagine this piece of steel is a piece of land, and you are going to walk in a straight line from one side to the other, from A to B. If it's completely flat land, like a polished surface, the distance you'll walk will be considerably less, than if you were to walk from A to B across mountainous land. That's essentially what a blasted profile is – a mountain range of peaks and valleys of varying sizes on the surface. The steel panel is still the same size, but the surface area within it has increased – and in all directions. It is this increased surface area that ensures that a coating adheres (or sticks) to the substrate.

Surface profile should not be confused with roughness. Surface profile is a measurement of the peak-to-valley height. Surface roughness, on the other hand, is the combined measurements of the surface profile and the frequency of the peaks across a linear length (also known as the peak count). Surface roughness is measured using a stylus instrument, which follows a similar linear path as our A to B example, only over a shorter distance.

So, now that we have defined surface profile as the peak-to-valley height, why is it important for the coatings industry to measure it?

Quite simply, to avoid corrosion. Corrosion is typically caused when three things come together – a ferrous material (in our case the steel substrate – although it is worth noting that non-ferrous materials can also corrode), oxygen (from the air) and moisture. If you can remove just one of the 3 elements, corrosion (or more precisely aerobic corrosion) simply cannot happen. Applying a coating to the steel provides a barrier between the steel and both the air and moisture, preventing corrosion. So if the coating is damaged, or simply rolls off the surface due to poor adhesion, then the steel will rust, corrode, and in time weaken the structure. Not exactly ideal if you are coating a bridge for example.

Now, whilst we know that the surface profile increases the surface area, and through this the adhesive properties of the coating, how do we know what surface profile is required?

Well, quite simply, this is specified by the coating manufacturer or the coating specification agreed to by all parties, and is directly related to the specified dry film coating thickness being applied.

Typically the surface profile specified is the peak-to-valley height in either microns or mils. The coating is also specified in either microns or mils, as a dry film thickness. The key here is that the required coating thickness is applied to both the valleys and the peaks, otherwise you get rust spots.

So, if the profile is too high, the amount of paint used to cover the peaks is significantly more, otherwise there are thin areas of cover – resulting in poor protective properties, leading to rust rash and early failure.

If the profile is too low, then the coating applied can be too thick, leading to possible cracking of the coating whilst it dries (or cures), resulting in corrosion and pinholes. Not to mention that there may also be an insufficient surface area to provide a suitable key for the coating - leading to poor adhesion and premature coating failures.

So, how do we measure surface profile?

To find out, you can watch the next part of this video by clicking one of the links on-screen, or simply visit Elcometer.com. And please, don't forget to subscribe to the Elcometer Channel to be notified of any new videos.