

Dr. Anthony C. Hart of Hart Coating Technology discusses the merits of stainless steel flake pigments and believes it is important to achieve quality in both appearance and durability

# From the bottom of ones's Hart

As published in *Paint & Resin Journal*, Issue No. 6, 1999

## Stainless steel

Because of its excellent reputation for quality and durability stainless steel has for the last 70 years become the material of first choice for an immense range of industrial and consumer applications. In addition to exhibiting excellent mechanical properties, combined with a high resistance to both corrosion and abrasion, stainless steel also has an extremely attractive metallic appearance. This allows it to be utilized in a multitude of applications where aesthetic, as well as durability, considerations are important. Its success can be measured by the current annual production, which is in the region of 15 million tonnes.

There are several hundred different grades of stainless steel available; these fall into three basic categories austenitic, ferritic and martensitic. In general the austenitic grades, which contain relatively high levels of chromium and nickel together with additions of molybdenum, provide the best overall performance.

## Stainless steel flake pigments

Although the vast majority of stainless steel is employed in bulk form it is obviously a desirable material for use in coatings on account of both its appearance and its physical properties. Unfortunately, stainless steels cannot be easily electrodeposited due to their complex chemical composition. As a result, development of a reliable commercial process by which these materials can be electroplated has proved to be an elusive goal. However, stainless steel pigments are readily available in the form of small flakes that can be incorporated into organic-based materials – in much the same way as other metallic pigments can – to produce a range of different types of coating.

Stainless steel flakes for this type of application are manufactured from austenitic UNS-S31603 grade material (formerly known as AISI Type 316L). This is a high performance stainless steel containing typically 17% chromium, 13% nickel and 2% molybdenum; in its bulk form this finds many demanding roles in chemical plant manufacture. The flakes are typically between 0.5 and 1.2 micrometers thick with an aspect ratio of in the region of 30/60:1. They are available in a number of size ranges and also as leafing and non-leafing grades; these factors can be used to achieve a variety of visual effects. Typical screen analyses for two of the grades are:

- \* 70% from 44 to 58 micrometers
- \* 90% below 44 micrometers

A special grade is also produced with much lower flake thickness – in the region of 0.3 micrometers – and a small flake size. This produces coatings with a “gray” appearance, not dissimilar to that of pewter metal.

A further benefit derived from the excellent corrosion resistance of stainless steel is that the flakes exhibit very high stability when incorporated into aqueous-based coating formulations.

### **Versatility of stainless steel flake pigments**

Leafing grades of stainless steel flakes are particularly suitable for use in powder coating products where they show excellent long term stability in external atmospheric exposure situations and are therefore widely used in high quality architectural applications.

In addition they are eminently suitable for use in solvent-based formulations since their high chemical stability makes them compatible with almost all of the commonly used resin systems. Incorporation of stainless steel flakes into epoxy based coatings provides a particularly attractive combination due to the high resistance to chemical attack of both the pigment and the main system. Solvent-based paints containing stainless steel flakes find particular application in the food industry – for example for coating of processing machinery – since they are resistant to the stringent cleaning regimes necessary in this application.

In view of the excellent inherent stability of stainless steel flakes in aqueous based formulations. Special Water grades have been developed for this type of resin system specifically to avoid problems of saponification.

The availability of stainless steel flakes in a variety of grades provides a wide degree of flexibility. Combined with their excellent general properties this allows them to be incorporated into virtually all of organic resin media to provide coatings with excellent properties and a range of different appearances.