

SOME POSSIBLE ALTERNATIVES TO HEXAVALENT CHROMIUM PASSIVATES

Introduction

Before considering the alternatives it is important to understand some of the properties of conventional hexavalent passivates:

- One of the main benefits (and the reason for its impending ban) is that on the surface of a hexavalent passivated component there is a supply of 'free' hexavalent chromium. This can react with moisture in the surroundings to form additional passivate when the part is damaged or scratched. This 'self healing' property is especially useful when components are mechanically handled after plating.
- A strong yellow colour is a good indicator of the quality of the passivate coating.
- It is relatively cheap chemistry and an inexpensive process, run at room temperature.
- It is readily available – all zinc electroplaters will have it available.

Trivalent alternatives for zinc coatings

- **Bright / clear passivate** (sometimes known as blue) is readily available in trivalent form. It is a thin film coating which gives minimal corrosion resistance (8 – 24 hours to the onset of white corrosion).
- **A new thick film trivalent passivate** to replace the traditional yellow. This will offer similar, and in some cases slightly better, corrosion resistance than the old hexavalent yellow and is clear in appearance with an iridescent effect, but not bright and blue.
It will give better tolerance to heat, some manufacturers are claiming up to 200°C before the coating denatures.
It is not self healing.
- **Black and Olive Drab.** The favoured alternative to hexavalent black is to convert to a zinc iron coating with a trivalent black. Not only does this overcome the hexavalent problem but also offers a better black finish with improved corrosion resistance.

To date there is no trivalent alternative to olive drab passivation and in general it would appear that yellow as a colour for components on automobiles is on the way out, silver and black will be the new standards.

Trivalent alternatives on zinc alloy coatings

- Zinc Nickel alloy will be available with a clear iridescent passivate similar to that replacing the yellow on normal zinc coatings. Its' performance to white corrosion will be similar but the fact that it is not self healing could reduce its capability slightly.
- Zinc Iron, as mentioned above will give access to a new good quality black in trivalent form.

Requirement for top coats / sealers

- As these hexavalent free passivates are not 'self healing' top coats or sealants may be required where extended mechanical handling of the component after plating may damage the passivate prior to assembly.
- Organic coating such as emulsified wax is one option to improve torque tension as well as corrosion performance.
- Inorganic sealers such as silicates are well suited to those components that will be mechanically handled. This hardens the coating to protect it from damage as well as increasing the corrosion resistance. Additionally it is possible to build in a torque tension lubricant into the coating.

Commercial implications

- All of these trivalent passivates will be more expensive. The chemistry costs are up to 5 times that of hexavalent yellow, the concentrations required are 12 times greater and the solution must be heated to 60 - 70°C.
- The additional costs will need to be carried by the automotive manufacturers, one of which has openly stated that they would expect the cost of plating to rise by 15 – 20% in order to meet this legislation. Naturally the overall effect on the cost of the major subassemblies, and the car itself, will be minimal.
- Current ongoing parts will need to be changed to a new finish and perhaps re-submitted for approval.
- All new components will need to be designed and approved with this legislation in mind.
- Hopefully manufacturers will specify trivalent passivates to achieve a given corrosion performance rather than specifying a particular chemical supply houses' process – this could lead to even greater price increases.
- The supply chains' ability to deliver 'cost down' as well as this improved environmental performance will be a problem over the forthcoming years.