

HEXAVALENT CHROME

(HEX CR)

Replacements



Hard Chrome

Replacements

- ❑ Electroless nickel has been shown to replace some hard chrome applications with less machining after plating with similar hardness after baking.
- ❑ Some other type deposits have also proven successful but with increased costs.
- ❑ Some hard chrome finishes can not be replaced.
- ❑ Trivalent chrome at this time will not work to replace hex hard chrome.



Decorative Chrome

Replacement

- ▣ Exterior Automotive
- ▣ Interior Automotive
- ▣ Plumbing
- ▣ Hardware
- ▣ Appliances
- ▣ Furniture
- ▣ Shiny, Durable, Color



Decorative Chrome

Replacement

- ❑ Original Hex Chrome was replaced by trivalent (tri) chrome
- ❑ First generation trichrome had much better coverage than hex but color was darker
- ❑ Trichrome plated as easily as nickel but did not passivate unplated areas like hex chrome did.
- ❑ Tri chrome was less tolerant of metal contamination
- ❑ First generation was either sulfate or chloride based
- ❑ Second generation is much bluer and closer in color to hex chrome but with hex chrome limitations and trichrome limitations (poor covering power, much less tolerant of metal contamination)



Chromic Acid Anodizing Replacement

- ▣ Aircraft requirement – New specifications have replacement for chromic acid anodizing but not all end users accepting new finish
- ▣ On military specification – military calls out new finish but also has jobs using old hex only



Chromic Acid Passivation

Replacement

- ❑ On Mil Spec – new specifications have citric acid passivation as a replacement for hex chrome/nitric passivation
- ❑ Used for 400 series Stainless Steel – medical industry has banned any hex chrome/nitric passivation and only allows citric based chemistry
- ❑ Still some jobs call out hex chrome /nitric passivation



Hexavalent Chromates

Replacement

- ▣ Used to extend the corrosion resistance of different substrates, plated steel (zinc, zinc alloys or cadmium), aluminum and ZDC
- ▣ Used for color identification (**yellow**, black, **olive drab**, **blue**, **green**, **etc**).
- ▣ Required by Mil Spec (Mil 5541 Type 1)
- ▣ Used as paint base (Painting aluminum airplane bodies)



Hexavalent Chromate

Replacements

- ▣ Still used to extend the corrosion resistance of the substrate (steel plated with zinc, zinc alloys, and cadmium (Yes it's still around)), ZDC and aluminum
- ▣ Still used for color identification but now the colors easily achieved are *clear, blue, black* (on some surfaces), other *colors* (yellow, red, metric blue, green, etc) are all done with dyes on zinc, zinc alloys and cadmium. Olive drab while easily done with hex chrome and dyed anodized finishes is not yet capable with tri chromates. Dyed black is not possible due to size of black particle.
- ▣ Cont.



Hexavalent Chromate

Replacements

- ▣ Mil Spec 5541 now has Type 2 Class 1A and 3. Both require a non hex chrome finish. No finish under Type 2 can achieve color (yellow) at this time all that is available is the Navy's Trivalent Chrome Passivate and others non-chrome passivates.
- ▣ Hex paint bases have been replaced by non-chrome passivates.
- ▣ There is a demand for colored finishes on aluminum that can be applied as the old hex chromate could.
- ▣ Many issues in the field have come up with the performance of the new aluminum finishes.



Chromic Acid Seals

- ▣ Sealing of anodized coatings – non chrome seals are typically used today
- ▣ Sealing of phosphated metals – non chrome seals have been shown to out perform some hex chrome seals used in the past.



Chromic Acid Etch

Replacements

- ▣ Plating on Plastics – makes plastic hydrophilic (water loving) – replacements involve expensive vacuum chambers and works on direct line of site preventing many parts from being successfully processed.
- ▣ Deburring of metals – dissolves burrs – other chemical processes can be used but are either more aggressive or not as affective
- ▣ Polishing of metals – even removal of surface defects polishing surface – new procedures may also lead to tarnishing and attack of the substrate.



Hexavalent Replacements

- ▣ All new procedures require more control
- ▣ Are less robust
- ▣ May be more expensive to use and make up along with disposal costs (increased waste treatment costs)
- ▣ May not meet customers needs, color, feel, matching of product in the field.
- ▣ Military jobs still call out hex chrome products
- ▣ Additional training of personnel needed to accept new processes.

