

Trivalent Chromate vs. Trivalent Passivate

By George Bokisa

The terms “Trivalent Passivate” and “Trivalent Chromate” are used interchangeably in the industry to describe relatively thin, sacrificial protective layers containing complex Cr^{3+} salts that are applied to zinc and zinc alloy deposits, which have themselves been applied over steel substrates to improve the corrosion resistance of said substrate.

The term “Trivalent Passivate” is more correct. At its root, “Chromate” is a reference to salts that contain the chromate anion, CrO_4^{2-} . This anion contains chromium in its Cr^{6+} state. The European legislation ELV (Directive 2000/53/EC, etc.) and further environmental legislations (RoHS and WEEE) have led to the elimination of hazardous substances from coatings, resulting in the ban of Cr^{6+} from corrosion protection layers and forced the industry to convert to Cr^{3+} based post treatments.

However, the terminology lagged. When Cr^{6+} was the standard, films were generically referred to “chromates” and just differentiated by their color. With the advent of Cr^{3+} technologies, the term “Trivalent” was used to differentiate Cr^{3+} technology from the Cr^{6+} they were replacing, even though term “Trivalent Chromate” is oxymoronic. To correct this, the term “Trivalent Passivate” became more descriptive, especially since the films often contain more than just Cr^{3+} salts. However, the old term was often written into specifications and still is used interchangeably.