Chromate Check SWABS Quality testing products from Hybrivet Systems, Inc. P.O. Box 2425 Natick, MA 01760
Phone: (508)651-7881 Fax: (508)651-8837 www.LeadCheck.Com

ChromateCheck™ Swabs

A Rapid Screening Test for Surface (CrO_4^{2-}) Ions

BACKGROUND

Hexavalent chromium is recognized as a carcinogen. It has been used in a variety of products including conversion coatings (used in plating) to enhance corrosion protection, for appearance and as an adhesion film for organic coatings. Recent RoHS directives ban the use of hexavalent chromium targeting primarily corrosion resistant coatings applied to plating. Although there is no universal replacement for Cr^{6+}, trivalent chromium is the most common replacement. The trivalent chromium conversion coating is not considered to be as hazardous as the hexavalent chromium product. A number of conversion coatings have been developed with trivalent chromium and provide acceptable corrosion resistance. Some of these products may contain Cr^{6+} as a contaminant (usually small amounts).

PRODUCT

ChromateCheck™ Swabs are a rapid screening test for the detection of chromate (CrO_4^{2-}) ions. The test is specific for hexavalent chromium and can detect 1 to 2 micrograms on a solid surface. The test does not detect trivalent chromium and can be used to distinguish Cr^{3+} from Cr^{6+}. In order to determine total chromate (Cr^{3+} and Cr^{6+}) it is necessary to oxidize the test sample with peroxide or another oxidizing agent.

METHOD

1. Activate the swab by crushing at two points indicated on the barrel of the swab and shake vigorously for 30 seconds to mix the reagents .
2. Apply gentle pressure to the swab until liquid is at the tip.
3. Continue to squeeze the Swab gently and Rub the surface for about 30 seconds to 1 minute.

INTERPRETATION

If the tip of the swab turns light pink/purple to purple, hexavalent chromium is present. There is a possibility that trivalent chromium is contaminated with hexavalent chromium as well as some other contaminants. Usually the level of contamination is reported to be low. If the hexavalent chromium contaminant concentration is high enough (greater than 1 microgram in the area tested) the swab will turn light pink/purple. The lower the amount of Cr^{6+}, the lighter the pink/purple color that develops on the swab. See the color chart in applications note CR-3.

Quality testing products from Hybrivet Systems, Inc. P.O. Box 2425 Natick, MA 01760
Phone: (508)651-7881 Fax: (508)651-8837 www.LeadCheck.Com

Performance Curve for ChromateCheck™ Swabs

A Chromate (VI) atomic absorption standard was used to test the sensitivity of ChromateCheck™ Swabs. The concentration of the standard was between 5 micrograms and 0.0375 micrograms. ChromateCheck™ Swabs were used as directed. A clear gradation in color was observed as the concentration varied from high to low. No color develops in the absence of chromate. The test results are pictured below. (Developed swabs were placed in a test tube rack for the picture.)

5.0 2.5 1.25 0.62 0.31 0.15 0.075 0.037
Micrograms of Hexavalent Chromium

HIGH
5 micrograms Cr (VI) to 1 µg

MEDIUM
0.62 micrograms Cr (VI) to 0.31 µg

LOW
0.05 micrograms Cr (VI) to 0.037 µg

Applications Note: CR-5 ChromateCheck™ Swabs Standard Curve

ChromateCheck™ SWABS
Quality testing products from Hybrivet Systems, Inc. P.O. Box 2425 Natick, MA 01760
Phone: (508)651-7881 Fax: (508)651-8837 www.LeadCheck.Com

PERFORMANCE CHARACTERISTICS OF ChromateCheck™ SWABS II (Cat. # MTL-7CR8)

I. The Reaction

A ChromateCheck™ Swab contains two glass ampoules each containing the reagents required for the colorimetric detection of chromium (VI). One ampoule contains a dye reactive with Chromium (VI) which under the proper conditions of pH and solvent conditions turns deep pink/purple. The second ampoule contains the buffers and solvents required to optimize the reaction of chromium (VI) with the dye. ChromateCheck™ provides careful control of the ratio of solvent to dye which provides a reproducible and reliable test. The reaction leads to a light pink/purple to deep purple result on the tip of the swab (depending on the concentration of chromium (VI) present). Color development is linear with concentration.

II. Sensitivity

To determine the sensitivity of ChromateCheck™ Swabs, a standard curve was prepared with a solution of chrome (6) AA standard at a concentration of 984 µg/ml was used. Dilutions of the standard were used to determine the standard curve. For testing 100 µl of each dilution was placed on plastic weigh boats. A clear color progression was observed. At the highest concentrations the color is saturated.

The following table illustrates the reaction of ChromateCheck™ Swabs to each concentration.

Chromate Tested (µg)	Color Result	Rating (%)
9.8	Deep purple	100
4.9	Deep Purple	93
2.4	Purple	86
1.2	Purple	71
0.98	Medium to dark purple	64
0.49	Medium to dark purple	50
0.24	Light purple	28
0.12	Light purple - easily seen	14
0 (no Cr (VI))	Colorless	0

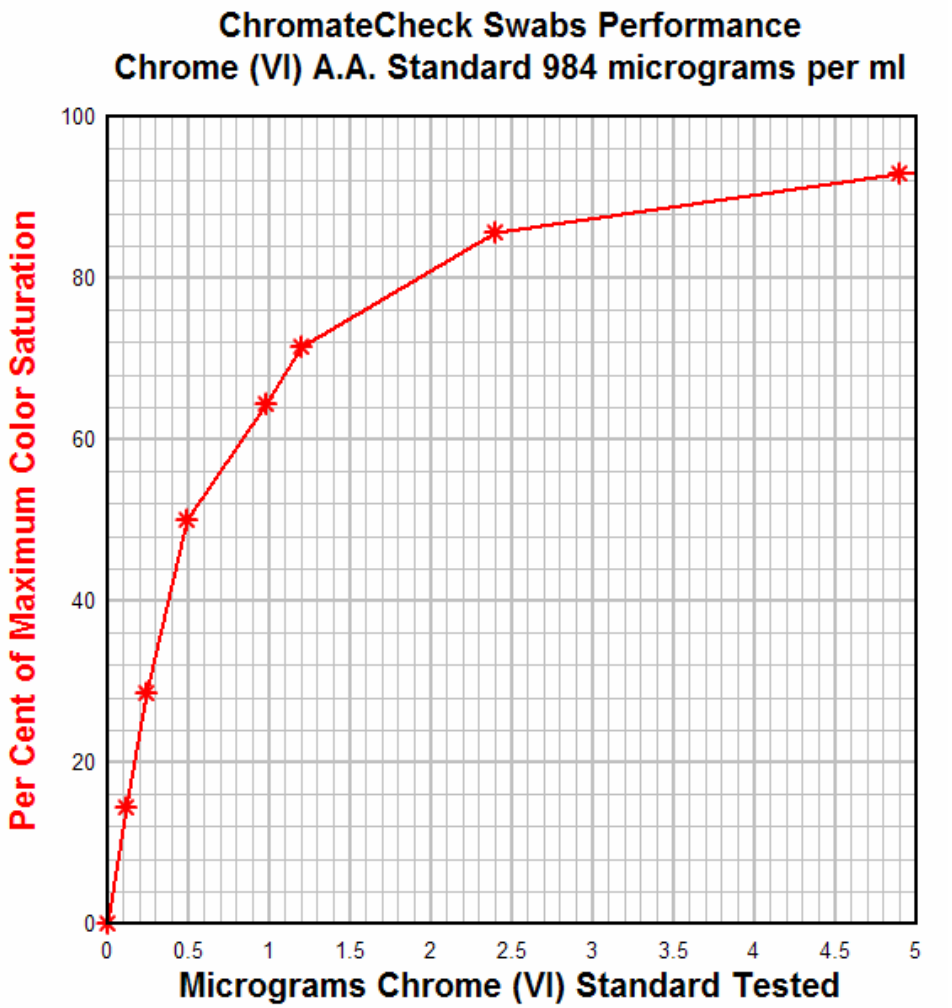
These reactions were repeated five times with the same results. A clear gradation of color was observed and an arbitrary rating was assigned to each with 7+ indicating the 100% color saturation.

III. Specificity

ChromateCheck™ Swabs are quite specific for chromate. High levels of mercuric chloride (5mg/ml) interfere with color development, however at 1.5 mg/ml no interference is observed. High concentrations of molybdate may interfere with color development.

IV. Reaction with Lead Chromate paint

ChromateCheck™ Swabs (MTL-7CR8) detect chromate in lead chromate paint at the same levels as found for the potassium chromate standard.



Legend

Standard curves were developed using several lots of the new version of ChromateCheck™ Swabs. A standard solution of 984 micrograms/ml chromate was diluted to produce the concentrations used in each series of experiments. The results of several curves were averaged and have been summarized in the above graph. The intensity of the purple/pink color developed at each of the concentrations was scored as a percentage of the maximum color developed.

Chromate Check SWABS Quality testing products from Hybrivet Systems, Inc. P.O. Box 2425 Natick, MA 01760
Phone: (508)651-7881 Fax: (508)651-8837 www.LeadCheck.Com

ChromateCheck Swabs Reaction with Other Metals

To determine interferences of other metals with the ChromateCheck Swabs (pH <2), 100 ul of each of the following metal salts were placed in a plastic weigh boat and tested for reaction with ChromateCheck Swabs.

Crossreactant	Concentration	ChromateCheck Color
Copper Sulfate	10 mg/ml	Colorless
Ferric Chloride	5 mg/ml	Colorless
Ferric Sulfate	10 mg/ml	Colorless
Nickel Chloride	5 mg/ml	Colorless
Lead Nitrate AA Std	1 mg/ml	Colorless
Silver Nitrate	0 mg/ml	Colorless
Cadmium Chloride	10 mg/ml	Colorless
Magnesium Acetate	10 mg/ml	Colorless
Palladium Chloride	5 mg/ml	Colorless
Barium Chloride	1 mg/ml	Colorless
Manganese Sulfate	10 mg/ml	Colorless
Mercuric Chloride	1.5 mg/ml	Colorless
Chrome (III) Chloride	10 mg/ml	Colorless
Lead Chromate	11.5 ug Cr (+6)/ml	deep purple/pink

Chromate Check SWABS Quality testing products from Hybrivet Systems, Inc. P.O. Box 2425 Natick, MA 01760
Phone: (508)651-7881 Fax: (508)651-8837 www.LeadCheck.Com

Qualitative Analysis of Cr-VI in Layers on Metal Parts

Principle of the Method

Under strong acid conditions, Cr-VI reacts in a series of steps which lead to the formation of a violet complex when tested with ChromateCheck™ Swabs. All the reagents required for the test are contained in two ampoules inside a ChromateCheck™ Swab. One ampoule contains the acid reagent; the other contains the reactive dye.

Surface Preparation

The surface of the part to be tested should be clean, free of dirt, finger prints and other impurities. If the surface is contaminated with oil, it should be cleaned before the test with a suitable solvent at room temperature and dried with oil free compressed air.

Once cleaned, the testing surface must be scored with a sharp object (such as a blade or a glass cutter). Cut a minimum of 1 X 1 centimeter square into the surface. Make 10 to 15 diagonal cuts diagonally (left to right) within the square. Then make another 10 to 15 cuts across the first set this time at a right angle to the first set, and again 10 to 15 times across the other diagonal. This step might destroy existing top coats.

Testing

1. Crushing at two points on the barrel of the swab (marked A and B).
2. Shake vigorously for about thirty seconds to ensure mixing of the reagents.
3. While squeezing the swab, rub the prepared surface (be sure to keep pressure on the barrel of the swab to prevent reagent “suck back”).
4. After two to three minutes a pink to purple color appears on the tip of the swab if Chrome VI is present.
5. The intensity of the color provides an estimation of the Cr (VI) content inside the layer.

Interpretation:

This piece of plated metal was positive for hexavalent chromium.

Description

- Colorless indicates no Cr (VI) is detectable (<0.02 µg/sq cm) and the part is considered Cr (VI) free.
- Very little pink/purple indicates < 1 µg/sq cm and suggests that further analysis might be necessary.
- Light pink/purple (clearly visible) indicates >5 µg/sq cm and the part contains Cr (VI).
- Intense pink/purple indicates >10 µg/sq cm and the part contains Cr (VI).

Interferences

No other metals react and Cr (III) does not react with ChromateCheck™ Swabs.
Trivalent chromium (Chrome III) DOES NOT react with the ChromateCheck™ Swabs to give a pink/purple color.

ChromateCheck™ SWABS
Quality testing products from Hybrivet Systems, Inc. P.O. Box 2425 Natick, MA 01760
Phone: (508)651-7881 Fax: (508)651-8837 www.LeadCheck.Com

PERFORMANCE CHARACTERISTICS OF ChromateCheck™ SWABS II (Cat. # MTL-7CR8)

I. The Reaction

A ChromateCheck™ Swab contains two glass ampoules each containing the reagents required for the colorimetric detection of chromium (VI). One ampoule contains a dye reactive with Chromium (VI) which under the proper conditions of pH and solvent conditions turns deep pink/purple. The second ampoule contains the buffers and solvents required to optimize the reaction of chromium (VI) with the dye. ChromateCheck™ provides careful control of the ratio of solvent to dye which provides a reproducible and reliable test. The reaction leads to a light pink/purple to deep purple result on the tip of the swab (depending on the concentration of chromium (VI) present). Color development is linear with concentration.

II. Sensitivity

To determine the sensitivity of ChromateCheck™ Swabs, a standard curve was prepared with a solution of chrome (6) AA standard at a concentration of 984 µg/ml was used. Dilutions of the standard were used to determine the standard curve. For testing 100 µl of each dilution was placed on plastic weigh boats. A clear color progression was observed. At the highest concentrations the color is saturated.

The following table illustrates the reaction of ChromateCheck™ Swabs to each concentration.

Chromate Tested (µg)	Color Result	Rating (%)
9.8	Deep purple	100
4.9	Deep Purple	93
2.4	Purple	86
1.2	Purple	71
0.98	Medium to dark purple	64
0.49	Medium to dark purple	50
0.24	Light purple	28
0.12	Light purple - easily seen	14
0 (no Cr (VI))	Colorless	0

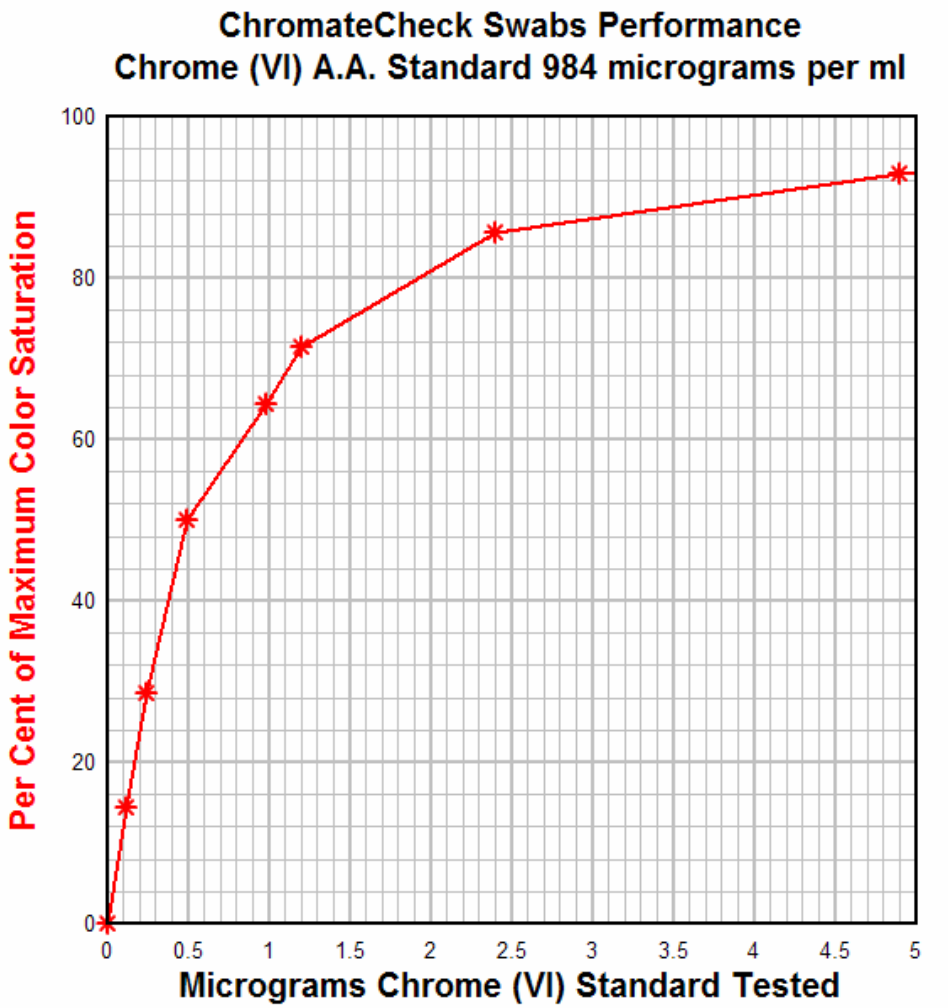
These reactions were repeated five times with the same results. A clear gradation of color was observed and an arbitrary rating was assigned to each with 7+ indicating the 100% color saturation.

III. Specificity

ChromateCheck™ Swabs are quite specific for chromate. High levels of mercuric chloride (5mg/ml) interfere with color development, however at 1.5 mg/ml no interference is observed. High concentrations of molybdate may interfere with color development.

IV. Reaction with Lead Chromate paint

ChromateCheck™ Swabs (MTL-7CR8) detect chromate in lead chromate paint at the same levels as found for the potassium chromate standard.



Legend

Standard curves were developed using several lots of the new version of ChromateCheck™ Swabs. A standard solution of 984 micrograms/ml chromate was diluted to produce the concentrations used in each series of experiments. The results of several curves were averaged and have been summarized in the above graph. The intensity of the purple/pink color developed at each of the concentrations was scored as a percentage of the maximum color developed.