

Nye-Tef™

Electroless Nickel + PTFE Plating

NYE-TEF is a PTFE Composite coating solution exclusive to Electro-Coatings, for applications requiring both exceptional resistance to friction and peak performance in coating adhesion. The process combines the **self-lubricating properties of PTFE** with the **high wear resistant hardness of electroless nickel**, and has excellent adhesion which allows for an increased control on uniform thickness.

More than an Electroless Nickel Coating

Electroless nickel plating has been used industrially in the United States since 1954. Since the plating process is strictly chemical, it evenly coats all prepared surfaces with a deposit highly uniform in thickness, as well as in chemical and physical properties. A search for improvements in the properties and performance of electroless nickel coating resulted in the introduction of composite plating.

Electro-Coatings has been a pioneer in the development of composite coatings and has the skill and expertise to maintain the dispersion of particles in the plating solution and incorporate them in the growing metal film as a stable dispersion.

The Plating Process

The plating process takes place at about 90°C and the coating can be applied to almost any metallic substrate. Polytetrafluoroethylene (PTFE) is added to the plating solution with the appropriate blend of surficants enabling the polymer to be codeposited as the nickel plating proceeds to an inclusion level of about 20-25% volume.

The presence of the PTFE imparts a pewter-like, matte gray appearance to the deposit. NYE-TEF coating has PTFE dispersed throughout the deposit thickness, which is the key to the success of this coating. The NYE-TEF coating is not merely electroless nickel coated with a surface PTFE film, but it is an in-depth reservoir of PTFE that is constantly exposed in any wearing environment, thus maintaining a constant supply of PTFE throughout the life of the coating.

NYE-TEF coatings have a bulk hardness of 32 Rc and with heat treatment at 300°C for ~4 hours, this value is raised to 50 Rc. The adhesion of the deposit passes the ASTM E290 bend test of 180° without flaking or detaching.

Application Benefits

Low friction / self lubricating surface. The dry lubricant PTFE is one of the lowest friction materials known. Although rather soft in its bulk form, PTFE particles suspended and constrained in the supporting nickel matrix provide an excellent low friction surface.

Wear resistance. Electroless nickel has a hardness of approximately 52 Re and can be increased to 70 Re through heat treatment. The NYE-TEF coating as deposited is approximately 32 Re. The deposit hardness, coupled with the low friction PTFE, provides an excellent wear and abrasion resistant finish.

Uniform thickness. The NYE-TEF coating deposition process is an autocatalytic deposit which provides an extreme uniformity of thickness to within ±10%, with even hidden areas evenly coated.

Corrosion resistance. NYE-TEF coatings have a non-crystalline structure, providing superior corrosion resistance.

Excellent adhesion. Chemical bonding of the coating results in strong adhesion to the metal substrate.

NYE-TEF Applications

Because of its unusual combination of thickness uniformity, low friction, wear resistance, and corrosion resistance, the NYE-TEF coating has particular applicability to the following:

- Valves
- Carburetor components
- Fuel injection components
- Hydraulic systems
- Pneumatic systems
- Pumps
- Rotors
- Drives
- Bearings
- Gears
- Film dies
- Mold cores
- Oil Drilling Components
- Nuts and bolts for precision applications
- Ball and butterfly valves
- Pistons
- Molds for plastic and rubber components

Quality Coating Service Since 1956

Electro-Coatings is a pioneer in providing electroless nickel plating to U. S. industry. It owns the Kanigen® electroless nickel process, which was the first commercially used electroless nickel in the United States.

Electro-Coatings is also a pioneer in the development of composite coatings. It holds patents for silicon carbide composites in electroless nickel and the NYE-TEF coating. Both are produced at its Houston, Texas plant.

FRICITION TEST DATA

This table presents the results of coefficient of friction test conducted on samples of steel coated with NYE-TEF.

- Avg. Static Coef of Friction: 0.15
- Avg. Kinetic Coef of Friction: 0.13

Test Method: ASTM D 1894, Standard test method for Static and Kinetic Coefficients of Friction of Plastic Film and sheeting

Sample	Weight (lbs)	Pull	Static Force (lbf)	Kinetic Force (lbf/in)	Static Coeff. of Friction	Kinetic Coeff. of Friction
Nye-Tef™	0.855	1	0.1	0.11	0.11	0.12
		2	0.15	0.11	0.16	0.12
		3	0.15	0.12	0.17	0.12
		4	0.15	0.12	0.17	0.13
		5	0.14	0.12	0.15	0.13
Average			0.14	0.12	0.15	0.13
Standard Deviation			0.02	0.01	0.02	0.01

Testing data analysis was completed on January 28, 2008.

WEAR TEST DATA

This report presents the results of Taber Abrasion test conducted on samples of coated steel plates.

Average Weight Loss

- Average (grams): 0.6639
- Standard Deviation: 0.0305

Average Change in Thickness

- Average (inches): 0.0011
- Standard Deviation: 0.0003

Test Method

ASTM D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser (Deviations from Method: Samples were applied to the tile. Testing done using H22 wheels, 1000 gram weight, 1000 cycles).

Taber Abrasion - Weight Loss				
Sample ID	Specimen	Initial Weight (grams)	Final Weight (grams)	Weight Loss
Nye-Tef™	1	137.656	136.971	0.6855
	2	137.245	136.603	0.6424
	Average			0.6639
	Standard Deviation			0.0305

Testing data analysis was completed on March 21, 2008.

Taber Abrasion - Depth of Wear				
Sample ID	Site	Initial Thickness (inches)	Final Thickness (inches)	Change in Thickness (inches)
Nye-Tef™ 1	1	0.0694	0.0683	0.0011
	2	0.0685	0.0672	0.0013
	3	0.0684	0.0677	0.0007
Nye-Tef™ 2	1	0.0683	0.0668	0.0015
	2	0.068	0.067	0.001
	3	0.0679	0.067	0.0009
Average				0.0011
Standard Deviation				0.0003

Testing data analysis was completed on March 21, 2008.

888-739-2502

www.electro-coatings.com

 ElectroCoatings  @ElectroCoatings