

The Basics of Pre-Treatment

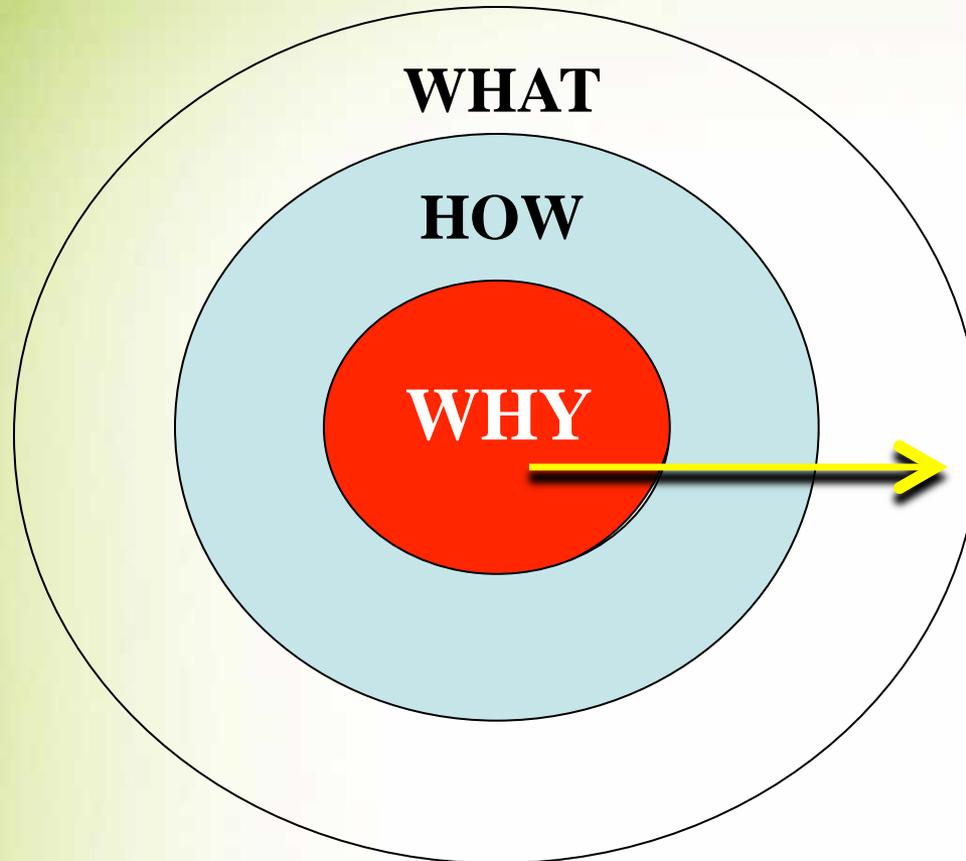
“Surface Finishing 101”



Presented by
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“Start with Why” — *Simon Sinek*



Surface Finishing “ 101”

WHY?

- **What Is Pretreatment**
- **Soils**
- **Conversion Coating**
- **Types Of Conversion Coatings**

HOW ?

- **Application Methods**
- **Variables**
- **Rinses**
- **Selection**
- **Next Generation Conversion Coatings**

Full disclosure Transparency

As a Chemical Technical Sales Rep I' ll be speaking on the use of chemistry as the main focus.

“Better living through Chemistry”

*The phrase **Better Living Through Chemistry** is a variant of a DuPont advertising slogan*

WHY?

Why do we apply chemicals or otherwise treat the surface of a substrate before we paint it?

Purpose of Pretreatment

- To help make paint adhere to metal
- Make a painted surface last longer
- Enhance rust and corrosion resistance of metal
- Metal needs to be clean to allow good paint adhesion
- Good paint adhesion ensures long life of the painted surface
- Properly applied pretreatment when coupled with quality paint enables metals to resist rust or corrosion much better than paint alone

Paint doesn't like to adhere to these soils

Organic

- Mill Oils
- Cutting Oils
- Slushing Oils
- Quenching Oils
- Stamping Compounds
- Rust Inhibitors
- Drawing Compound
- Buffing Compounds

Inorganic

- Heat Scale
- Rust
- Carbon
- Smut
- Dust
- Particulates
- Tarnish
- Oxidation

Different soils may require different cleaning chemicals

- Alkaline Cleaners-typically used for fatty/oily soils
- Solvent Cleaners-good for oily soils
- Acidic Cleaners-good for soils such as oxidation, rust and scale
- Physical-when all else fails

Key Process Indicators

The **WATCH** Principle

- **W**ater (quality/TDS levels / contaminants)
- **A**ction (impingement / contact)
- **T**ime (contact time of solution to part)
- **C**hemical (concentration / pH / the right 1)
- **H**eat (operating temperature of solution)

Pretreatment

Conversion Coating Adds Value To The Finished Part by:

- 1) Improving Adhesion Between The Metal Substrate And The Paint**
- 2) Protecting Against under paint Corrosion**

Substrate/Structural Failure

Types Of Conversion Coatings

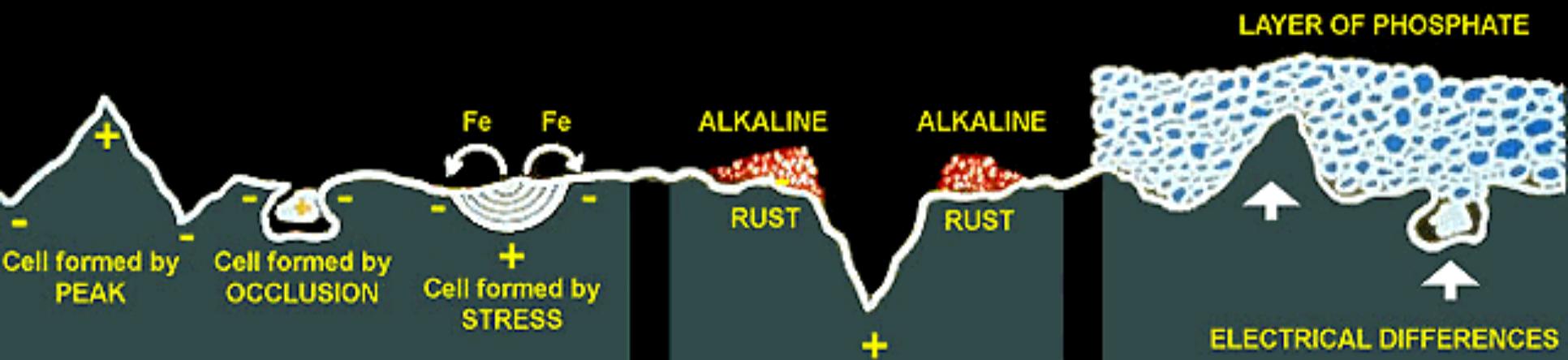
- **Iron Phosphate - *Steel, Aluminum , Galvanized***
- **Zinc Phosphate - *Steel, Aluminum , Galvanized***
- **Chromate Coatings - *Aluminum***
- **Chrome Phosphate - *Aluminum***
- **Chrome Free Coatings *for Aluminum***
- **Phosphate Free – *Zirconium / Vanadium / Titanium / Silane***

Traditional Conversion Coatings

(Iron Phosphate)

**Dilute Aqueous Solutions - Mainly Acidic
React With The Metal Surface And Produce Dense,
Continuous Layer Of Inert Crystalline Or Amorphous
Coatings**

- **Conversion Coating Becomes An Integral Part Of The Surface**
- **Metal Surface Is Irregular, Electrically Conductive - Susceptible To Corrosion**
- **Converted Surface Is Uniform, Non-Conductive And Inert - Capable Of Inhibiting The Spread Of Corrosion Creepage Under The Paint Film**



Other Conversion Coatings

(Non-Phosphate)

Dilute Aqueous Solutions - Mainly Acidic React With The Metal Surface and produce a thinner continuous layer of a deposition coating.

- **Coating Becomes An Integral Part Of The Surface**
- **Converted Surface Is Uniform, Non-Conductive And Inert - Capable Of Inhibiting The Spread Of Corrosion Creepage Under The Paint Film and often out-perform traditional Phosphate coatings (NSS)**
- **Because they are thinner (nano coating weights) they often do not hold up to excessive impact or bending/forming after painted**

Iron Phosphate

- **A Conversion Coating Formed Primarily On Steel, Aluminum And Galvanized, By Reacting These Surfaces With A Dilute Solution Containing Phosphoric Acid, Salts And Other Additives**
- **An Insoluble Coating Containing Metal Phosphate Is Deposited On The Metal Surface**

Composition Of Surface Finishing Solutions

- **Partially Neutralized Acids**
 - **Accelerators**
 - **Surfactants (optional)**
 - **Chelates (optional)**
 - **Fluorides (optional)**

Accelerators

Apart From the Acid And The Salts “Accelerators” Are The Most Important Components Of Surface Finishing Solution (chemistry).

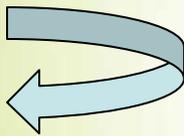
They Speed Up The Coating Formation

- **By Increasing The Rate Of Metal Dissolution**
- **Deposition of Transitional Metal**
- **Precipitate Excess Iron As Sludge**

Most Common Applications

Spray/Immersion

5 Stage Process

- Clean
 - Rinse
 - Coating
 - Rinse
 - Final Seal/Rinse
- 

Spray/Immersion

3 Stage Process

- Clean & Coat
- Rinse
- Final Seal/Rinse

Spray Wand

Single or multiple steps

Other “SF” Applications

Mechanical Abrasion

Abrasion (mechanical) Abrasion is the process of scuffing, scratching, wearing down, marring, or rubbing away. It can be intentionally imposed in a controlled process using an abrasive. **Abrasion** can be an undesirable effect of exposure to normal use or exposure to the elements.

Sand/Grit/Steel media

Variables In Surface Finishing Coating Chemistry

- **pH**
- **Concentration**
- **Temperature**
- **Time**
- **Pressure**
- **Other Ingredients**
 - **Fluorides**
 - **Accelerators**
 - **Surfactants**
 - **Critical Elements (Zr / Fe / Si etc)**

Controlling the Variables



- **Concentration**: Primary Method is by manual titration of solution in bath.

QC Tip: Clean all glassware, titration equipment, do not cross contaminate testing reagents & solutions.

- **pH**., Hand held pH meter or Test strips

QC Tip: Hand held meters should be calibrated often-cross contamination of pH buffers should be avoided-pH probes are designed to wear out.

- **Temperature**: Most systems have some these built into to them. *A portable thermometer is always a good way to double check*
- **Pressure: Similar to temperature probes.** Physical inspection of unit and all nozzles/risers

Rinses

Rinsing after each chemical process is critical.

Why ?

- This ensures that all previous chemistry is removed from the work piece and not “carried” into the next chemical.
- Stops the reaction from taking place



What to look for

The lower the TDS (total dissolved solids) are in the bath the better, especially as the parts exists the system prior to paint

Final Rinses

- **Chrome Rinse**
- **DI / RO Rinse**
- **Non Chrome Rinse; Mildly Alkaline**
- **Non Chrome Rinse - Mildly Acidic**

Typical Coating Weights

	120°F			130°F		
	30s	60s	120s	30s	60s	120s
Moly	17	27	34	16	29	43
HAS	13	22	24	17	21	35
Ch	54	61	92	57	79	96

Non Phosphate

Conversion Coating
Chemistries

Phosphate Free

- Zirconates
- Silanes
- Polymers
- Titanium
- Vanadium

The Non Phosphate Movement

The WHY

Environmentally – The element “P” (Phosphorous) promotes Algae which deprives aquatic life of Oxygen

Energy – doesn't require heat, reduces CO2 emission, lowers energy consumption and saves \$\$

Performance - Meets or Exceeds Salt Spray performance vs. Iron Phosphate

Periodic Table of Elements

1	IA																					0		
1	H	IIA																5	6	7	8	9	10	
2	3	4																	B	C	N	O	F	Ne
3	11	12	III B	IV B	V B	VI B	VII B	VII					IB	IB	13	14	15	16	17	18				
4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36						
5	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54						
6	55	56	*La	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86						
7	87	88	+Ac	104	105	106	107	108	109	110														

* Lanthanide Series

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu

+ Actinide Series

90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Legend - click to find out more...

H - gas

Li - solid

Br - liquid

Tc - synthetic

 Non-Metals

 Transition Metals

 Rare Earth Metals

 Halogens

 Alkali Metals

 Alkali Earth Metals

 Other Metals

 Inert Elements





THANK YOU

**For attending the 2018
MN Paint and Powder Expo
and participating in this session.
If you have specific questions or
application needs please stop by our
booth – we'd be happy to talk to you in
more detail!**