Laser® FE

Laser FE is a room temperature, hydrogen peroxide-based immersion chemical polishing process designed to provide bright steel surfaces. It may also replace vibratory mass finishing of carbon steels. Benefits of using Laser FE in place of vibratory mass finishing include an extremely short process cycle and no loud or expensive vibratory bowls. Laser FE is based on environmentally friendly hydrogen peroxide.

Features & Benefits

No acid fumes	Safer to work with/Longer equipment life
Highly stabilized	High metal tolerance/Longer bath life
Quality Chemicals	Product and performance consistency
Short cycle time	High productivity

Typical Applications

- Chemical polishing of steel
- Deburring of carbon steels
- Scale Removal
- Surface preparation for further surface finishing

Operating Conditions

Time	30 seconds to 5 minutes
Agitation	Part movement needed
Replenishment	Use the Laser FE Replenisher to replenish acidity. Analysis for acid normality is on a following page. Periodic analysis of acidity is strongly recommended for process efficiency.

Use the Laser FE make-up concentrate to replenish the hydrogen peroxide. Analysis for hydrogen peroxide is performed periodically by the method on page 4.

Equipment

Tanks	Polypropylene, Polyethylene, PVC
Racks or baskets	Polypropylene, Polyethylene, PVC, Teflon

Because of the fluoride in this product, equipment made of fiberglass and Titanium must not be used. Teflon cooling coils are recommended. Reinforcement of plastic tanks is recommended.

Typical Process Cycle

Prior to processing in Laser FE, work must be clean and free of all rust, scale, or soils. NO EXCEPTIONS!

Step	Chemistry	Time(min)	Temp(F)
1. Cleaner	5 - 10		
2. Rinse	2		Cold water
3. Hubpik,	50% vol.	1 - 2	Ambient
4. Rinse	2		Cold water
5. Laser FE,	30% vol.	0.5 - 5	65° - 90°F
6. Rinse	2		Cold water
7. SR Post-Dip,	30% vol.	5 - 10	150°F
8. Rinse	2		Cold water
9. Dry or continue wet processing			

Metal Removal Rate

Metal removal rates encountered with the Laser FE process can vary widely with several factors. Among these are concentration, acidity, temperature and steel alloy. With a concentration of 30% by volume, room temperature 75ºF (24ºC) and SAE 1010 low carbon steel, the removal rate is approx. 60 micro inches (1.5 microns) per minute. As the temperature increases, the rate of metal removal increases.

Bath Capacity

Bath capacity will vary with differing steel alloys and factors such as drag-out, rinsing, operating temperature, etc. As an estimate, the bath will perform well until it has 2 to 3 ounces/gallon (15 to 22.5 grams/liter) of dissolved steel. For a SAE 1010 low carbon steel this should equate to roughly 8,000 ft^2 (743 $meters^2$) in a 200-gallon (757 liter) tank.

When alloys harder than SAE 1010 low carbon are run, the rate of etch will be lower and hence more footage can be run. These are estimate figures only and they may vary significantly from your alloy(s).

The Laser FE working bath is controlled by two titrations:

1. Acid Normality
2. Hydrogen Peroxide concentration

Generally, one should check and replenish the Laser FE concentration (Hydrogen Peroxide) first, then analyze for acid normality.

Laser FE Replenisher replenishes the acidity. The Replenisher is added periodically according to analysis. A decrease in activity on the part being processed is a good indication that a replenishment is needed, although analysis history will eliminate guesswork and provide consistent process results. Maintain normality at 0.412 N or as indicated by your initial make up concentration.

Laser FE replenishes the Hydrogen Peroxide. Maintain at 30% by volume or as indicated by your initial make up concentration.

IMPORTANT: If excessive gassing occurs while no work pieces are in the bath, or if the bath appears unstable, analyze the bath for acidity. An unstable bath usually means the acid normality is low.

Titration Method

Acid Normality

Chemicals required:

- 0.1N Sodium Hydroxide
- Potassium fluoride, powder
- Phenol red indicator, 0.1% in water

Procedure:

1. Pipet a 5 mL sample of Laser FE working bath into a 250 mL Erlenmeyer flask containing approx. 50 mL of DI water.
2. Add 1 gram of the Potassium fluoride and mix to dissolve.
3. Add approx. 10 drops of the Phenol Red indicator.
4. Titrate with 0.1N Sodium Hydroxide from yellow to a red endpoint.
5. Record mL used.

Calculation

$$\frac{(mL\ of\ titrant)\ (0.1)}{5.0} = Acid\ Normality$$

Maintain acidity with the Laser FE Replenisher between 0.300 to 0.414 N for a 30% Laser FE bath depending on the rate of metal removal desired. The higher the normality, the faster the metal removal rate. An acid normality concentration below 0.15 N may compromise bath stability. An acid normality higher than 0.414 N may result in etching of the work piece.

To Calculate Acid Replenishment

0.412 N is the target normality for a 30% Laser FE make up.
If the bath is made up at 15%, your target normality would be 0.206 N.

- Calculation for a 30% Laser FE bath. For a 15% Laser FE bath, insert the target acid normality accordingly

(0.412 N - result from analysis) (161) = mL of Laser FE Replenisher per liter of working solution

(0.412 N - result from analysis) (0.161) = gallons of Laser FE Replenisher per gallon of working solution

Example 1:
- 30% Laser FE bath is 250 gallons, acid normality is at 0.350 N

(0.412 N - 0.350 N) (161) = 9.98 mL/L of Laser FE Replenisher (total 9445 mL for the bath)

(0.412 N - 0.350 N) (0.161) = 0.01 Gal/Gal of Laser FE Replenisher (total 2.5 gal for the bath)

Example 2: 15% Laser FE bath is 200 gallons, acid normality is at 0.150 N

(0.206 N - 0.150 N) (161) = 9.02 mL/L of Laser FE Replenisher (total 6828 mL for the bath)

(0.206 N - 0.150 N) (0.161) = 0.009 Gal/Gal of Laser FE Replenisher (total 1.8 Gal for the bath)

Laser FE Concentration (Hydrogen Peroxide)
Chemicals Required
- 0.1N Potassium Permanganate
- 50% by volume Sulfuric Acid

Procedure
1. Pipet a 2 mL sample of Laser FE working bath into a 100 mL volumetric flask and add DI water to the mark. Mix well
2. Pipet a 10 mL sample of the aliquot into a 250 mL Erlenmeyer flask containing about 50 mL of DI water.
3. Add 10 mL of the 50% Sulfuric Acid solution.
4. Titrate with 0.1N Potassium Permanganate solution to a faint pink end that remains for approximately 20 seconds.
5. Record mL of titrant used.

Calculation

$$Concentration = mL\ 0.1N\ KMnO_4 \times 2.35$$

Maintain the Laser FE at 30% by volume or as indicated by your initial make up concentration.

Iron Concentration.
Chemicals Required
- 0.0575 M EDTA solution
- 5% Sulfosalicylic Acid solution

Procedure
1. Pipet a 5 mL sample of Laser FE into the 250 mL flask

2. Add approx. 50 mL of DI water and heat the flask to approx. 115°F.
3. Add 30 mL of the 5% Sulfosalicylic Acid solution.
4. Titrate with 0.0575 M EDTA solution to a yellow endpoint.
5. Record mL used.

Calculation

Iron (g/L) = mL 0.0575 M EDTA x 1.63
Iron (oz/Gal) = mL 0.0575 M EDTA x 0.217

Waste Disposal

Discharge to a disposal system. To be completely informed on the latest regulations for your area, please contact the local authorities.

Caution

DO NOT STORE USED LASER SOLUTIONS IN SEALED DRUMS. DISCHARGE USED LASER SOLUTIONS TO WASTE TREATMENT SYSTEMS EQUIPPED TO HANDLE THEM.

Laser FE make-up is an acidic, oxidizing liquid product and should be handled accordingly. Laser FE Replenisher is an acid fluoride solution. Avoid contact with skin and eyes. Wear protective clothing, goggles, and rubber gloves. Flush exposed areas immediately with clean, cold water. In case of injury, contact a doctor immediately.

The Laser FE bath is an acidic, oxidizing solution that must not encounter any metals except the work pieces being processed.

Laser FE make-up solution contains Hydrogen Peroxide. Hydrogen Peroxide is strongly oxidative and acts caustically on the eyes and skin. Self-ignition is possible if the liquid is soaked up by an inflammable material such as leather, paper, or cotton and allowed to dry. Protect eyes and skin.

Never allow the Laser FE working solution or concentrate to come in direct contact with the SR Post Dip working solution or concentrate. Never allow the Laser FE working solution or concentrate to encounter any alkaline solution.

Laser FE is a Hydrogen Peroxide mixture and should be stored in original vented container in a dry location, out of sun and away from heat. Empty containers should be diluted with large quantities of water and discarded. A spill or leak should be quickly flushed away by flooding with water.

Avoid contamination from any source, including metals, dust and especially organic materials. Avoid contact with combustible materials. Do not get in eyes - wear goggles. Avoid contact with skin - wear neoprene, butyl rubber or vinyl gloves. Wash thoroughly after handling. Do not breathe mists or vapors; adequate ventilation should be provided.

In the event the Laser FE drum begins to vent, immediately apply a cold-water spray to cool the drum. Do not physically handle the drum. Also, contact HUBBARD-HALL INC. for further assistance.

Our people. Your problem solvers.

For more information on this process please call us at
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