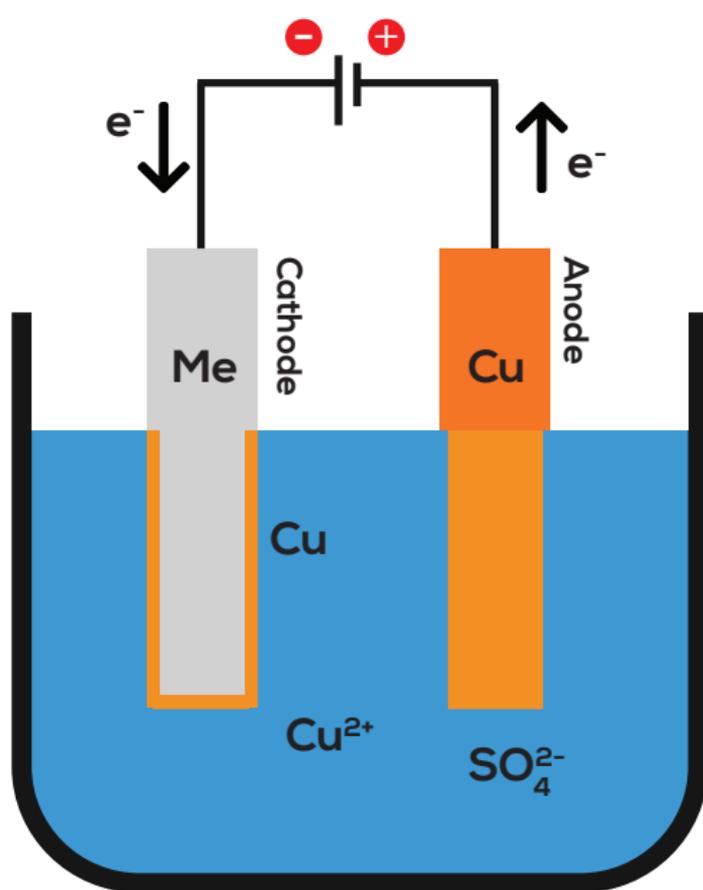


GEF - UNIDO - BEE PROJECT

on

"Promoting EE/RE in selected
MSME Clusters in India"

ELECTROPLATING



Electroplating

Simple Definition

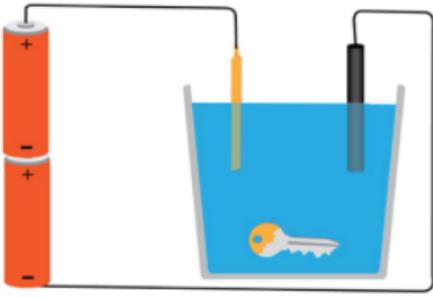
Process of depositing a layer of one metal over the surface of another metal by passing electric current is known as electroplating

The setup is composed DC circuit with an anode and a cathode sitting in a bath of solution that has the metal ions necessary for coating or plating



Confederation of Indian Industry

How Does Electroplating Work ?



- ↳ Needs a Liquid Electrolyte
- ↳ Negative electrode is the metal that will form the coating
- ↳ Positive electrode is the object to be plated
- ↳ Flow of electrons through the electrolyte deposits atoms from positively charged metal on to the negatively charged object

Electroplating Requirement and Process

Chemical Properties

- ↳ Increase Corrosion Resistance

Physical Properties

- ↳ Increase Thickness of Part

Mechanical Properties

- ↳ Increase Tensile Strength & Hardness

1. Surface Preparation Process

Cleaning → Rinse → Acid Dip → Rinse

2. Surface Treatment Process

Plating → Rinse → Finishing Treatment → Rinse

Different Type of Plating

Gold Plating

Silver Plating

Copper Plating

Rhodium Plating

Chrome Plating

Zinc Plating

Zinc-Nickel Plating

Tin Plating

Alloy Plating

Composite Plating

Cadmium Plating

Nickel Plating

Electroless Nickel Plating

Energy Intensive Equipment

- Electroplating and/or Anodizing
- Electric Tank Heating
- Air Agitation
- Hoists & Drives
- Oven Heating
- Blower or Exhaust Fans
- Pumps
- Hot Water Generator

Energy Conservation Opportunities in Electroplating

- Energy Efficient Rectifier System IGBT Vs SCR Vs Diode Based Rectifier
- Selection of Bus Bar Rating
- Automation of System
- Chemical Heating Electrical Vs Thermal Vs Solar
- Insulation of Tanks
- Pump selection and Control
- Blower selection and control
- Agitation Compressed Air Vs Lube Blower
- Basic Designing of Agitation system
- Evaporation Losses

Replace Diode Rectifier with IGBT Rectifier

Diode based rectifier - Old technology

IGBT rectifier - Latest technology

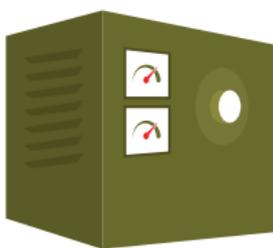
Low power consumption using IGBT technology

Saving potential of more than 35%

Experienced saving in range of 20 - 50 %

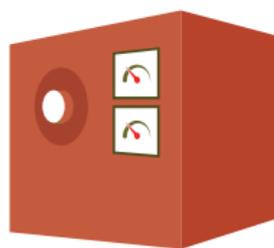
Average power saving potential of around 30%

Replace Diode Rectifier with IGBT Rectifier



Diode Rectifier

Old diode based rectifier- 5 nos
Power consumption - 47.88 kW



IGBT Rectifier

New IGBT based rectifier-5 nos
Power consumption - 14.50 kW

Annual savings = Rs. 5.60 Lakhs

Investment = Rs. 6.00 Lakhs

Payback period = 13 Months

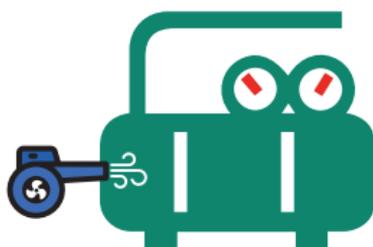
Replace Electrical Heating with Solar Water Heating



- Heater consumes high electrical energy
- High operating cost
- High maintenance
- Short Life
- Chemical deposition degrades performance and life
- Less safe than solar water heater

- Solar water heating system does not require external power
- Low operating cost
- Low maintenance
- Long life
- Safe & ease of operation

Replace Electrical Heating with Thermal Heating



- Electric heater consumes high power
- Heating cost for 100000 kCal/ hr system is Rs. 1088/hr
- Less economical

- Consumes less energy than electric heater
- Heating cost for 100000 kCal/ hr system is Rs. 750/hr
- More economical
- Saving potential of around 30 %

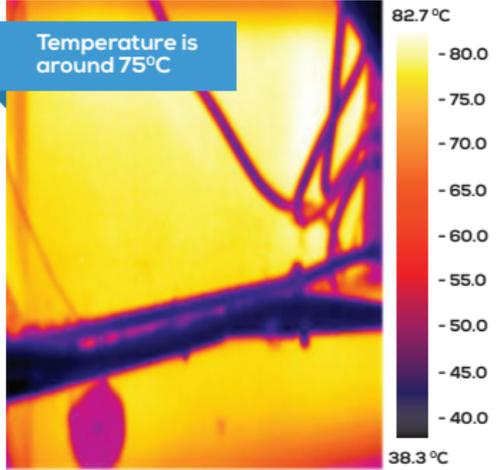
Annual savings = Rs. 12.42 Lakhs

Investment = Rs. 12.00 Lakhs

Payback period = 12 Months

Insulation - How Important ?

- Heater consumes high electrical energy
- High operating cost
High maintenance
- Short Life
- Chemical deposition degrades performance and life
- Less safe than solar water heater



Thermal Image of Plating Tank

Adequate insulation is must

What should be maximum surface temperature?

Surface temperature should not exceed +/- 10 degrees than room temperature

Radiation loss at 70 °C : 1440 Kcal/m²/hr

Radiation loss at 45 °C : 484 Kcal/m²/hr

@ 30 °C ambient temperature

3-fold decrease in losses by reducing radiation losses

Replace Pneumatic Equipment with Electrical Equipment

- Pneumatic pumps used for water circulation
- Compressed air is costliest utility
- Specific power consumption - 17 kW/100 cfm
- Electric powered equipment consumes 10% power than pneumatic equipment for the same application



Flow - 50 CFM
Power - 8.50 kW



Power - 1.0 kW

Annual savings = Rs. 4.17 Lakhs

Investment = Rs. 0.50 Lakh

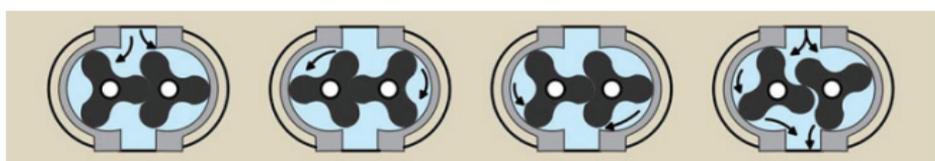
Payback period = 2 Months

Roots Blower Application for Agitation

- Agitation in plating tanks is very Important
- Most of the cases compressed air is used for agitation
- Compressed air generation is highly energy intensive
- Specific power consumption for compressed air generation 15 kW/100 CFM



High Pressure Compressed Air Using @ 7 kg/cm² for Agitation



Flow - 150 CFM
Head - 0.5 ksc
Power - 7.50 kW

- Agitation does not require high pressure air
- Air pressure requirement is not more than 0.5 kg/cm²
- Requirement is of air flow only
- Root blower specific energy consumption is 5 kW/100 CFM

Annual savings = Rs. 3.36 Lakhs
Investment = Rs. 1.00 Lakh
Payback period = 4 Months

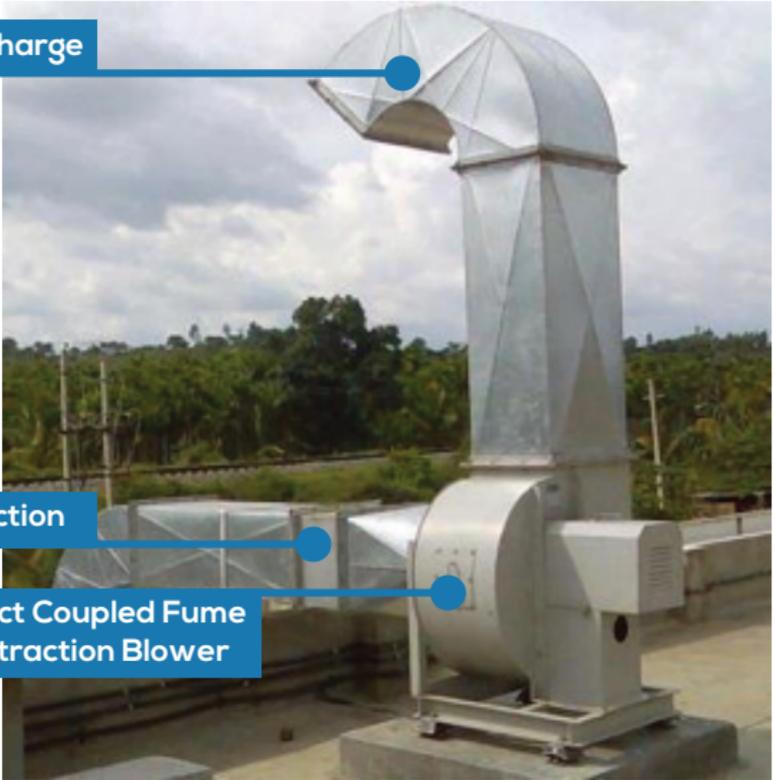
Effect Efficient Blowers

- Hazardous fumes release during electroplating process
- Fumes can be dangerous if inhaled
- Fume extraction is very important for safety aspect
- Blowers extract fumes from tank surface & releases to atmosphere

Discharge

Suction

Direct Coupled Fume
Extraction Blower



Low Temperature Long Life Cleaners

Importance of Cleaning

- **Improper substrate cleaning results in**
 - Visual plating/painting defects
 - Poor coating adhesion
 - Cross-hatch
 - Bend test
 - Boiling water
 - Blisters
- **Poor corrosion resistance**
 - Neutral Salt Spray (NSS)
 - Cyclic Corrosion
- **Rejects lead to costly rework and production inefficiencies**

Effect Efficient Blowers



Conventional alkaline cleaners are capable of removing many organic soils but have many process disadvantages:

- High operating temperatures (60-80°C)
- High energy costs
- Very short solution life

As organic soils are removed from the substrate surface, they become emulsified in solution, leading to the gradual decrease in cleaning performance until the solution must be replaced

Long Life Low Temperature Cleaners

Long life, low temperature cleaners naturally degrade the organic soils removed from substrate surfaces during the degreasing process, creating a more sustainable process

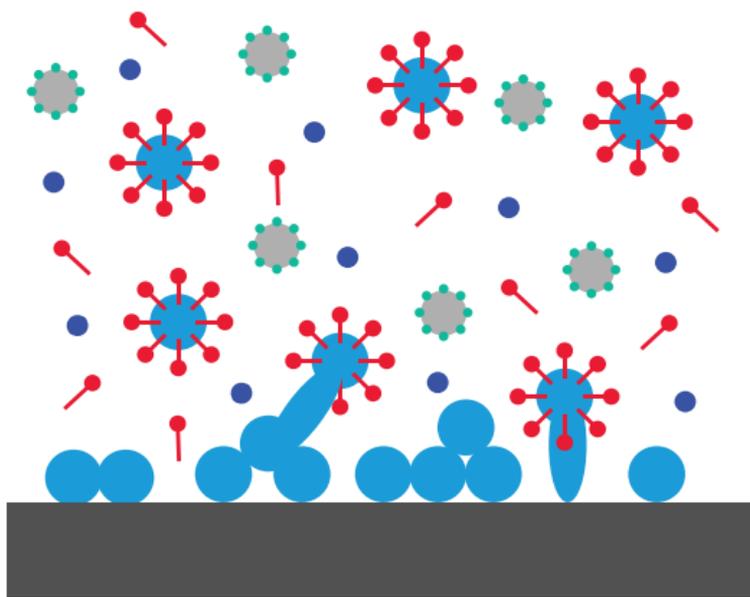
benefits as compared to conventional alkaline cleaners:

- Less frequent cleaner dumps/make-ups
- Easy to waste treat
- Low operating temperatures
- Less water consumption
- Reduce effluent treatment
- Significant energy & effluent saving

Approach



Cleaning Mechanism



Surfactant micelle



Water molecule alkalinity builders



Surfactant molecule



Oil, water, surfactant emulsion



Surfactant lifting oil of surface

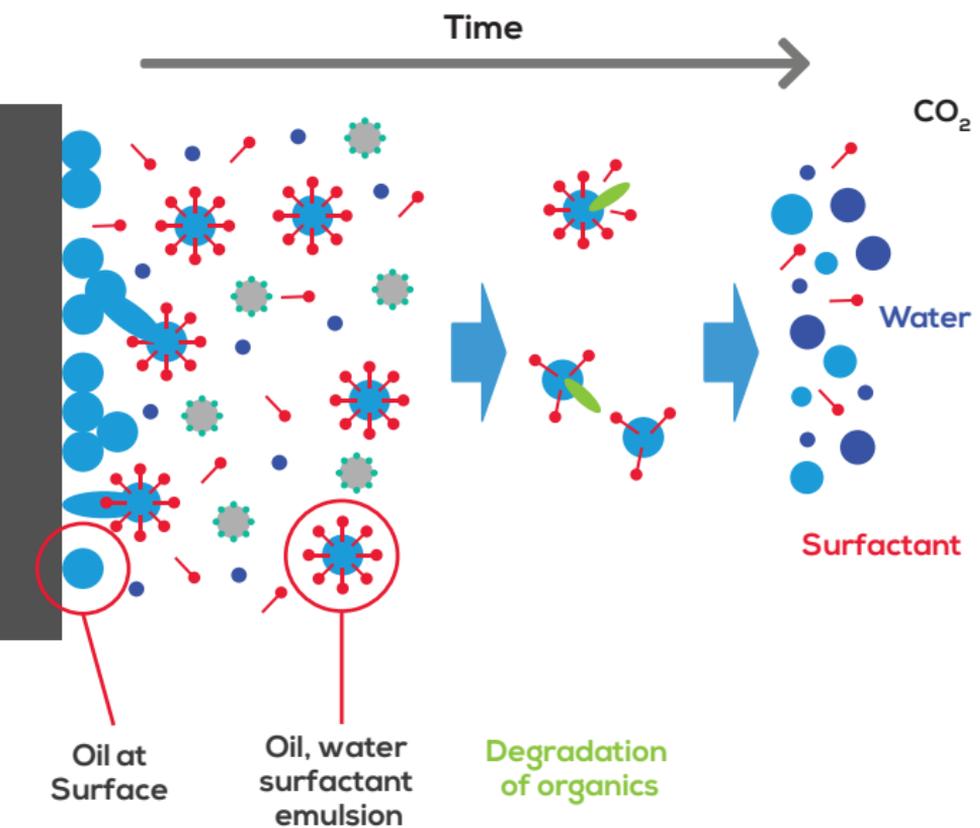


Oil on surface

Cleaning Mechanism

Mechanism for natural degradation of organics

- Surface is cleaned using highly emulsifying surfactant formulation
- Natural degradation of emulsified oil



Advantages of Low Temperature Cleaners

Low operating temperature results in substantial energy savings

Long life benefits include

- Increased productivity
- Waste treatment savings
- Chemical consumption and cost savings
- Doubled cleaner life is achievable with >98% of applications
- Many customers realize a 3-6 X increase in cleaner life as compared to a conventional cleaner

About Project

Promoting Energy Efficiency & Renewable Energy in Selected MSME Clusters in India

To develop and promote a market environment for introducing energy efficiency and enhanced use of renewable energy technologies in process applications in the selected energy-intensive MSME clusters under GEF UNIDO BEE project. The main objective of the project is to increase the capacity building of suppliers of EE/RE product and service providers

Disclaimer

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