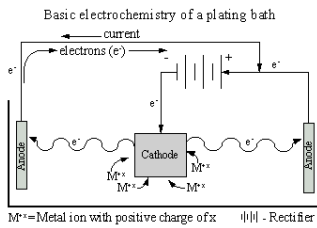


Process Hazards

Mike Slater
Diamond Environmental Ltd.

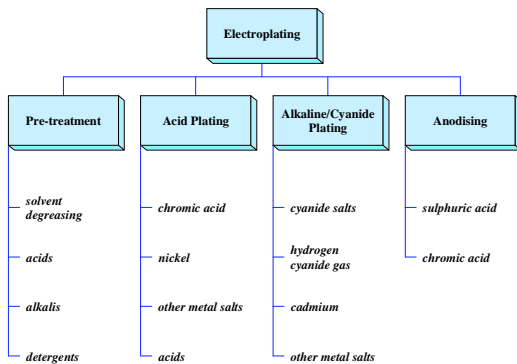
Metal Processes

Electroplating



Plating Process

- Stripping
- Cleaning
- Electroplating
- Post-plate treatments
- Rinsing



Metal Cleaning

- Solvent vapours
- Skin contact with acids and alkalis
- Release of NO_x, HF and HCl

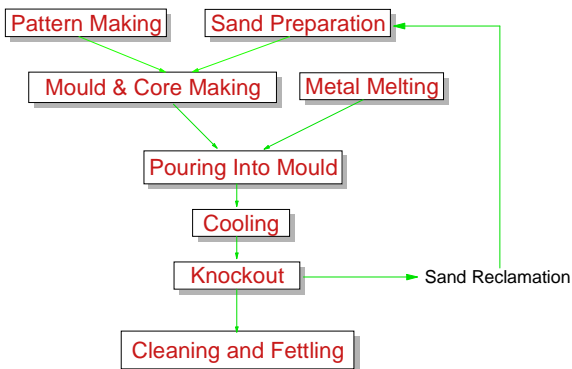
Electroplating Hazards

- Skin and eye contact with corrosive liquids
- Chromic acid mists
- Skin contact with metal salts
- Accidental ingestion of cyanide salts
- Hydrogen cyanide evolution
- Inhalation of dusts while making up solutions
- Formaldehyde (electroless plating)



Effluent Treatment

- Acid Stream
 - reduce Cr (VI) to Cr (III) with sodium metabisulphite
 - precipitate out metals using sodium hydroxide
- Cyanide Stream
 - treat with chlorine or hypochlorite to remove complex cyanides

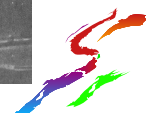
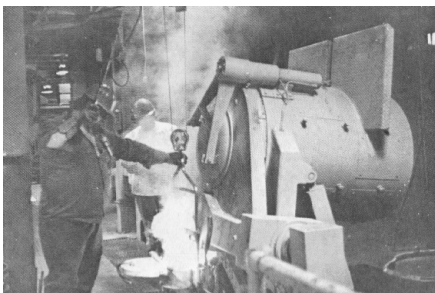


Casting - Resin Systems

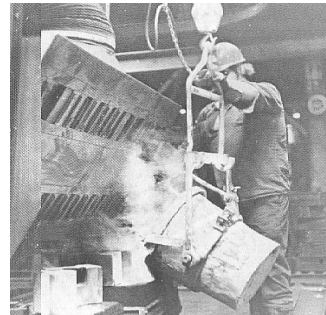
- cold setting oils
 - modified linseed oil
 - isocyanate hardeners
- furan process
 - furfuryl alcohol
 - furane resins
 - mineral acid catalysts
- phenol / formaldehyde
- urea / formaldehyde
- alkyd oil



Melting



Pouring



Fettling



Casting - Hazards

- Sand/ Mould/ Core Preparation
 - crystalline silica
 - resins
- Melting
 - metal fume
 - CO and other gases
- Pouring and Cooling
 - metal fume
 - CO and other gases
 - chlorine



Casting - Hazards

- Knock-out
 - crystalline silica
- Fettling
 - crystalline silica
 - noise and vibration
- Other Hazards
 - thermal stress
 - manual handling



Welding - Hazards

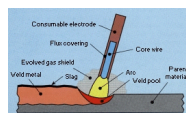
- UV radiation
- Metal oxide fume
- Fluorides and other components from flux
- Ozone
- Nitrogen oxides
- Gases generated by coatings or contaminants on metal



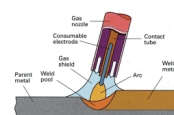
MMA welding



- Consumable electrode
- Flux coated rod
- Generates high concs of metal fume and ozone



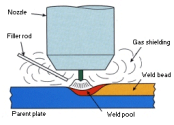
MIG Welding



- Metal Inert Gas
- Consumable electrode
- Uses inert gas to exclude air
- Generates
 - metal fume
 - ozone



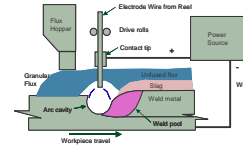
TIG Welding



- **Tungsten Inert Gas**
- Non-consumable electrode
- Little metal fume
- Main problem is ozone



Submerged Arc Welding

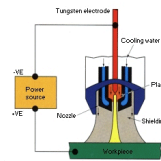


- Powdered flux covers arc and molten metal
- Minimal fume
- Limited application



Plasma Welding and Cutting

- Similar to TIG process
- Very high temperature
- Mainly used for cutting plate
- Manual and automated processes
- Fume, NO_x, ozone, UV, noise
- Underwater cutting
- Underbed extraction



Soldering and Brazing

- **Silver Soldering / Brazing**
 - type of gas welding
 - low M Pt filler alloy - different from base metal
 - fume mainly from flux
 - beware of cadmium containing rods
- **Soft Soldering**
 - lead / tin alloy
 - temperature usually below 400 C
 - too low for lead fume
 - main problem is fume from flux
 - rosin (respiratory sensitiser)



Metal Machining

- **Metal dusts**
 - risk depends on process
 - grinding and similar processes
- **Cutting Fluids**
 - mineral oils / synthetic fluids
 - dermatitis
 - skin cancer
 - oil mist



Solvent Processes

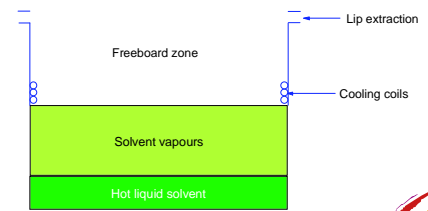


Metal Cleaning

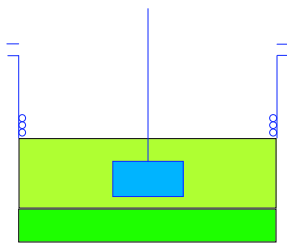
- Hand cleaning
- Cold cleaning
- Vapour degreasing



Vapour Degreasing



Vapour Degreasing



Vapour Degreasing Risks

- Exposure to vapour
 - escape from bath during degreasing
 - dragout
 - evaporation of excess solvent on components when removed from bath
- Skin contact
- Filling / emptying
- Cleaning out



Controls

- Operating procedures
- Cooling coils
- Thermostat
- Lid
- Lip extraction



Cleaning Degreasing Tanks

- Shut down
- Drain out solvent
- Avoid entry
- If entry necessary
 - treat as confined space
 - air supplied ppe
 - chemical protective clothing
 - harness and line
 - "safety person"
 - emergency procedure



Hand Cleaning

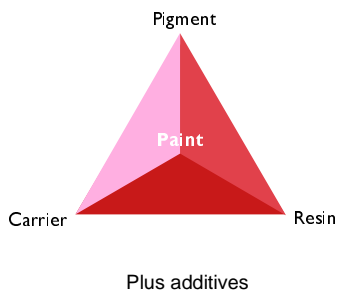
- Inhalation of vapours
- Skin Contact



Painting Hazards



Paint Composition



Paints

- Solvent based
- 2-pack polyurethane
- 2-pack epoxy
- Toxic pigments
 - e.g. lead, chromates
- Powder paints
 - no solvent
 - require heat curing
 - residual monomers (e.g. TGIC)
 - can contain toxic pigments



Painting - Surface Preparation

- Sanding, "rubbing down"
- Dusts
- Can contain toxic metal pigments



Paint - Application Methods

- Dipping
- Brush painting
- Spraying
 - liquids
 - powders



Dipping

- Enclose
- LEV
 - dipping
 - drying



Brush Painting

- Careful application
- Good general ventilation
- Good personal hygiene
- PPE



Spray Painting

- Local extraction
 - application
 - drying
 - ancillary processes
- Equipment selection
 - HVLP spray guns
- Spray pressure
- PPE
 - air fed RPE for high risk situations



Spray Booths

- Backdraught
- Walk in
 - downdraught



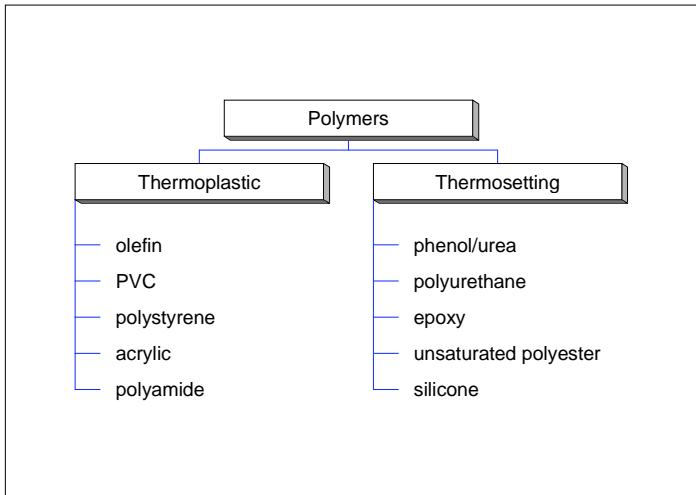
Painting - RPE

- Air fed mask is needed for
 - walk in booths
 - spraying 2-pack paints
 - spraying paints with toxic pigments




Polymer Processes






Polymer Manufacture

- Raw materials
 - monomers
 - additives (plasticisers, pigments etc.)
- Maintenance on reaction vessels
- Final products
 - powders
 - resins




Polymer Processing

- Raw materials
 - powders, resins additives
 - residual monomers
- Degradation fume and gases
 - purging, welding and hot cutting
- Coating and printing
 - solvents
 - UV cured inks - skin sensitisation, ozone
 - screen cleaning and reclamation




GRP Fabrication

- Styrene
- Catalysts
 - methyl ethyl ketone peroxide (MEKP)
 - benzoyl peroxide
- Accelerators
 - organic cobalt compounds
 - tertiary amines
- Glass fibre
- Cleaning solvents




GRP Fabrication

- Mixing resins
- Cutting glass fibre cloth
- Hand moulding
- Spraying fibre / resin mixture
- Trimming
- Large structures - confined spaces



Polyurethanes

- Foam moulding
- Packaging
- Urethane rubbers
- Hot wire cutting of polyurethane foam
- Textile lamination (flame bonding)
- Surface coatings, inks and adhesives
- Foundry binders
- Polyurethane coated solder wire

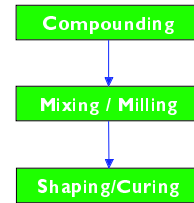


Polyurethane Foam Moulding

- Isocyanates
 - risk related to isocyanate used and process temperature
- Blowing agents
- Cleaning solvents
 - dichloromethane frequently used
- Dust from trimming operations



Rubber Manufacture



Rubber Additives

- "Cure package"
 - vulcanising agent
 - acclerator
 - activator
- Fillers
 - carbon black, silica
- Protective chemicals
 - antioxidants, antiozonants
- Plasticizers and processing aids
 - phthalates
 - oils



Rubber Processing

- Compounding
 - dusts
 - solvents and oils
- Mixing and milling
 - dusts
 - fume
- Shaping/Curing
 - fume
 - dusts (e.g. talc)
- Building
 - solvents
 - fume



Rubber Process Dust

- Dust arising in the stages of rubber manufacture where ingredients are handled, weighed, added to or mixed with uncured natural or synthetic elastomers
- Does NOT include dusts arising from the abrasion of cured rubber



Rubber Fume

- Fume evolved in the:
 - mixing, milling and blending of natural rubber or synthetic elastomers
 - natural rubber and synthetic rubber combined with chemicals
 - processes where blends converted to products
 - inspection processes where fume continues to be evolved



Banbury Mill



Moulding Tyres

