LESSON PLAN

Date_____ Trade:- Welder

Name_____ Unit/Lesson:-Forty Five

Subject:- Metalizing- types of metalizing, principles, equipments, advantages and applications. Manual oxy-acetylene powder coating process. Principles of operations and applications.

Motivation:- In previous lesson we discuss about Resistance welding process types, principles, power sources and welding parameters. Applications and limitations.

PREPARATION

1) (Materials, Tools, Models, Charts and other aids)

INTRODUCTION:- Metallization process is need to remove wear and tear with low cost.

Topic	Information Point	Spot Hint
Metalizing	This process was evented by Dr. Ulrich schoop in 1910. In this process we treated metal as per our requirement .	
How need	Due to wear and tear metal loss their property and need for metalizing process	
Wear	− mechanical; − corrosive-mechanical. Criteria: wear resistance (by mass/volume, relative)	
Methods of surface reinforcement	− penning; − surface alloying and hardening; − **coatings (sprayed coatings, vapor deposited coatings, cladded coatings, galvanic coatings, diffusion coatings);** metal cladding (bimetal materials).	
Process	▪ CHEMICAL ▪ ELECTROCHEMICAL ▪ THERMOCHEMICAL ▪ THERMOCOATING ▪ VAPOR DEPOSITION ▪ MECHANICAL	
Preparation of metals before metalizing		
Purpose: removal of contamintants, such as oil, rust, etc. ● chemical cleaning; ● vapor degreasing; ● baking (porous materials; 315 … 345 ºC);		

- ultrasonic cleaning;
- wet / dry abrasive blasting.

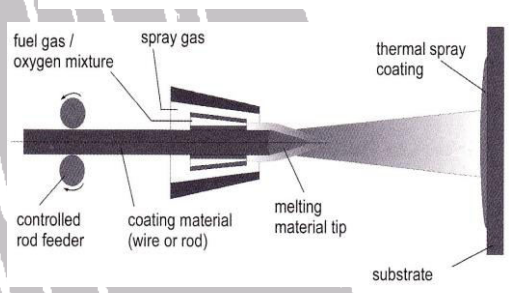
Purpose: to obtain clean in-plane (longtitudal) stress free surface with an increased area, providing bigger possibility for the sprayed material to form bonds and/or be mechanically interlocked with the surface.

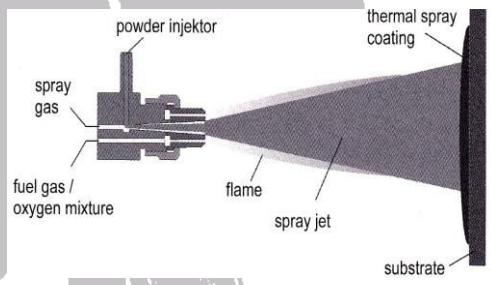
- dry abrasive grit blasting (angular chilled iron, crushed slag, flint, garnet, silica sand, Al_2O_3, SiC);
- machining or macroroughening.
- Rule of thumb: roughening must be done no longer than **2 h** before spraying Powders: drying at 100 ºC at least 8 h [1], polymer powders 50 ºC; 130 … 150 ºC 3 … 5 h, ceramic powders 600 … 700 ºC 3 … 5 h [4]; thickness of powder layer – no bigger than 20 mm [4]. Purpose: to eliminate moisture, in order to avoid the coalescence of powder during spraying and to avoid degradation of coating's properties through hydroxides' formation.
- Wires: cleaning using washing liquids, bronze wires – using acids [4]. Purpose: to remove lubricants / oxides.

Types of Metalizing:- Metal Spraying, Flame spraying, Thermal spraying

1918 TALLINNA TEHNIKAÜLIKOOL
TALLINN UNIVERSITY OF TECHNOLOGY

Flame spraying

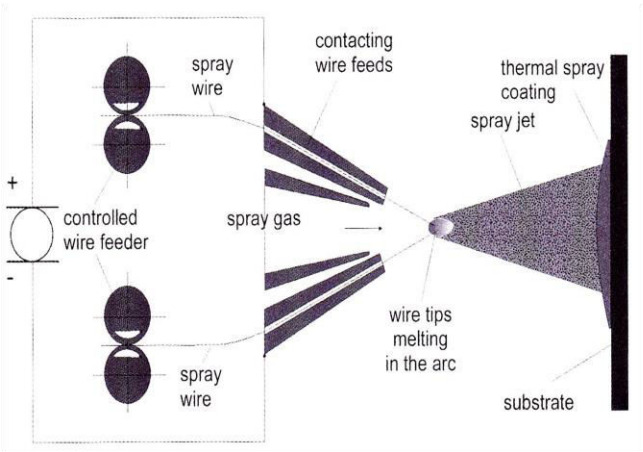




- flame temperature:
  - acetylene/oxygen 3160 ºC;
  - propane/oxygen 2850 ºC;
  - hydrogen/oxygen 2660 ºC.
- sprayed materials:
  - wire: metals and metal alloys;
  - powder: pure metals, alloys, oxides, cermets, composite powders.

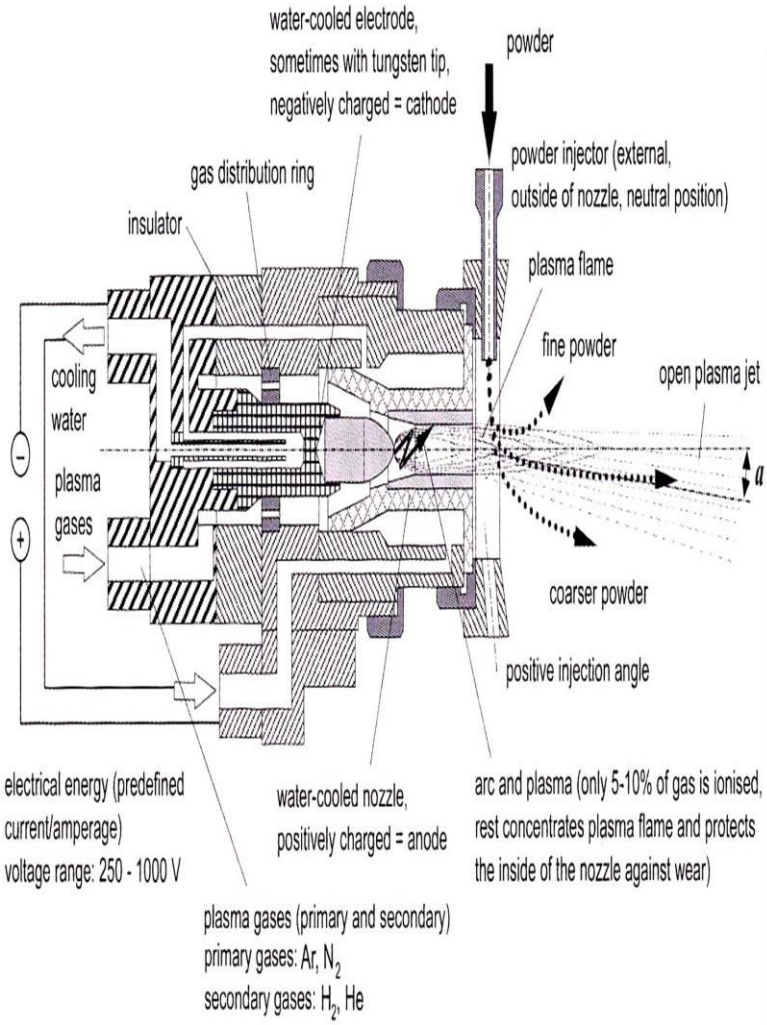
9

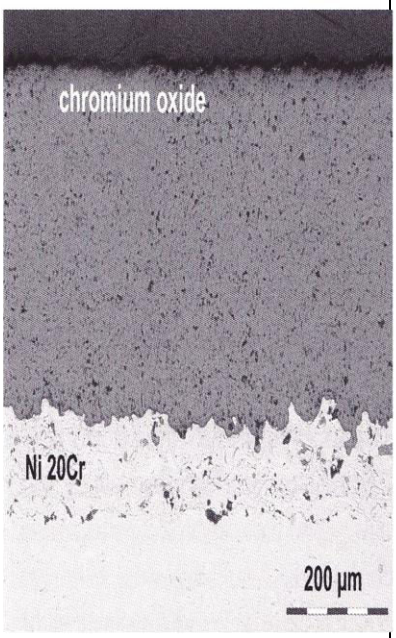
Arc spraying



- temperature inside the arc: 6500 ºC;
- voltage 18 – 40 V, current 50 – 150 A;
- sprayed materials: electroconductive alloys, ceramics can be deposited, when using core wires.

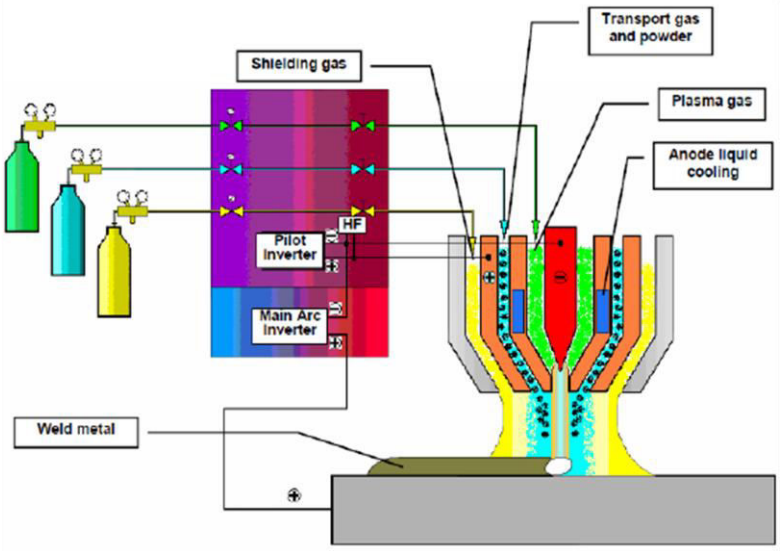
Plasma spraying

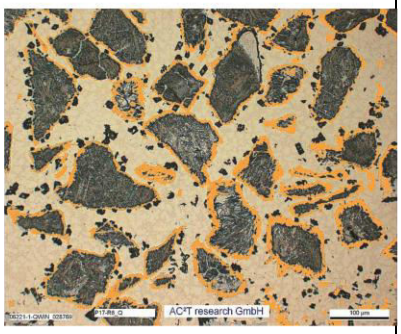




- plasma temperature: up to 30000 ºC.
- virtually all existing materials.

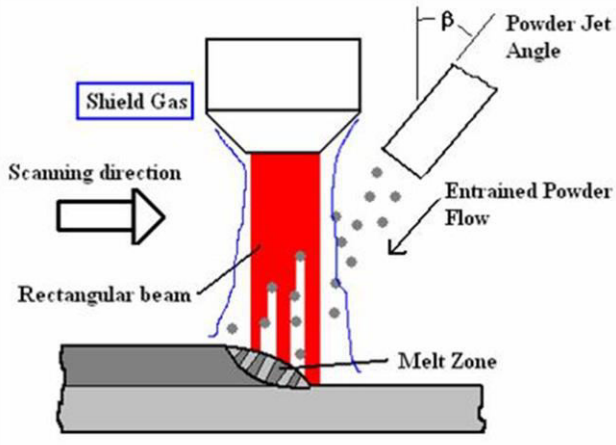
Plasma transfered arc spraying (PTA)

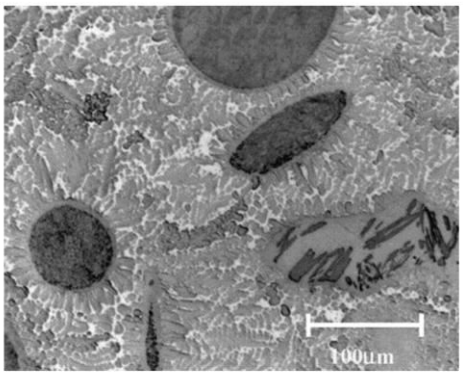




• Fe, Ni, Co, Cr based alloys, stainless steels, cermets

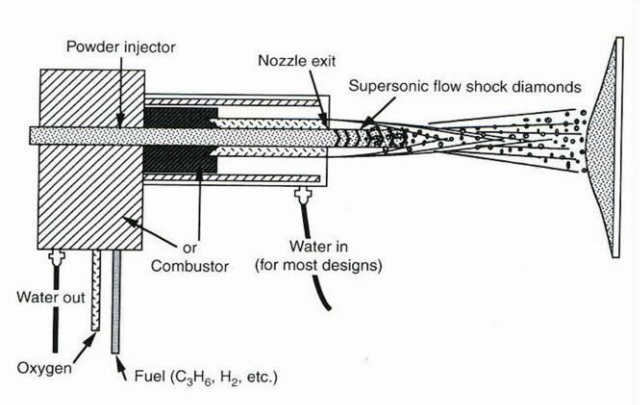
Laser cladding





• virtually all metal alloys, cermets and ceramics.

High-velocity oxy fuel spraying (HVOF)



• gas temperature: 3000 ºC;
• sprayed materials: virtually all existing materials, in practice mostly carbide/metal and carbide / self-fluxing alloy mixtures.

Comparison between all process

Spray technology	Velocity, m/s	Porosity, %	Adhesion, MPa
Flame spraying powder • wire	30 180	6 – 15	17 – 70 15 – 20
Arc spraying	240	2 – 8	40
Plasma spraying (different modifications)	240 – 1200	< (0,5 – 2)	20 – 70
Detonation gun spraying	910	< 1	≥ 100
HVOF, HVAF	610 – 1500	< 0,5	62 – 83
Cold spraying	500 – 1200	1 – 3	30 – 100

Applications of sprayed materials

Table 3. Examples of industrial applications of various thermally sprayed coatings.

Material group	Example	Properties	Examples of application
Pure metals	Zn	Corrosion protection	Metal structures in bridges
Self-fluxing alloys	Ni-Cr-B-Si	High hardness, nearly pore-less after fusing	Shafts, sleeves, seals
Steels	Fe-13Cr	Low cost material, wear resistant	Repair, wear propection
MCrAlY alloys	Ni-Cr-Al-Y	High temperature corrosion and oxidation resistance	Blades and vanes in gas turbines
Nickel-graphite composites	Ni-25C	Clearance control, abradable coatings	Sealing of air inlet channels in compressors
Oxides	Al_2O_3, Cr_2O_3	High hardness, good tem-perature stability	Parts in textile machines, paper machine cylinders
Hardmetal (carbides)	WC-12Co, Cr_3C_2-25NiCr	Wear resistance, high hard-ness	Valves, wear parts, paper machine cylinders

Multi-level Metallization

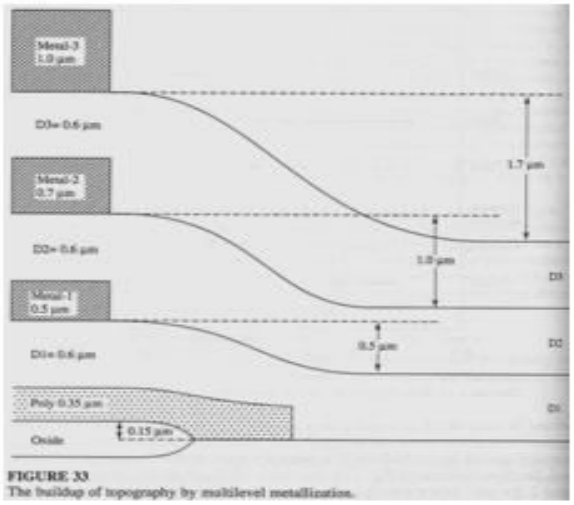


FIGURE 33
The buildup of topography by multilevel metallization.

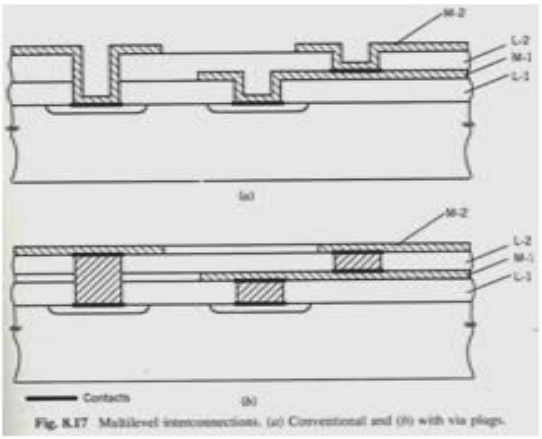
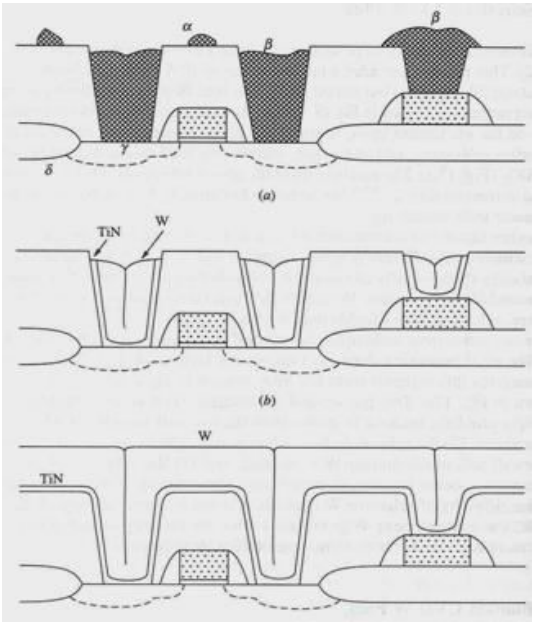
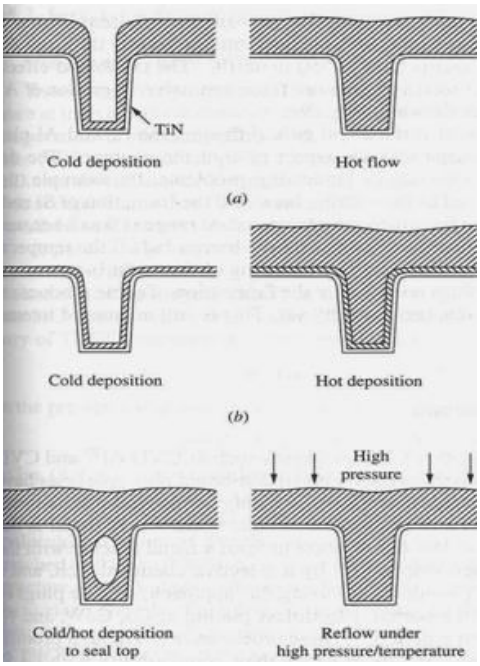


Fig. 8.17 Multilevel interconnections. (a) Conventional and (b) with via plugs.

Plug Filling





Questins:-

1. What is metalizing and how its need?
2. What is the process of flame spraying?
3. What is the process of arc spraying?

Next Lesson:- Welding codes and standards. Reading of assembly drawing. Welding procedure specification and procedure qualification records.

Assignments :- Metalizing- types of metalizing, principles, equipments, advantages and applications. Manual oxy-acetylene powder coating process. Principles of operations and applications.

Checked by…….. instructor……