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A MODULE
Introduction to the problems of welding

Alloying weld metal

Alloying weld metal

- The weld metal is alloyed to achieve the necessary physical, chemical and mechanical properties in different ways.
- Must be alloying elements that these properties guarantee the weld metal.

The weld metal may be alloying:

a) By using coated electrodes, the alloying of the weld metal is the transition elements of the core electrode or electrodes from the package, or the transition elements of the core and the shell electrode.

b) The transition of the alloying elements from the base material into the weld metal.

c) Using fluxes in arc welding under welding flux, which comprise alloying elements such as metal or oxide, or as ferroalloys.

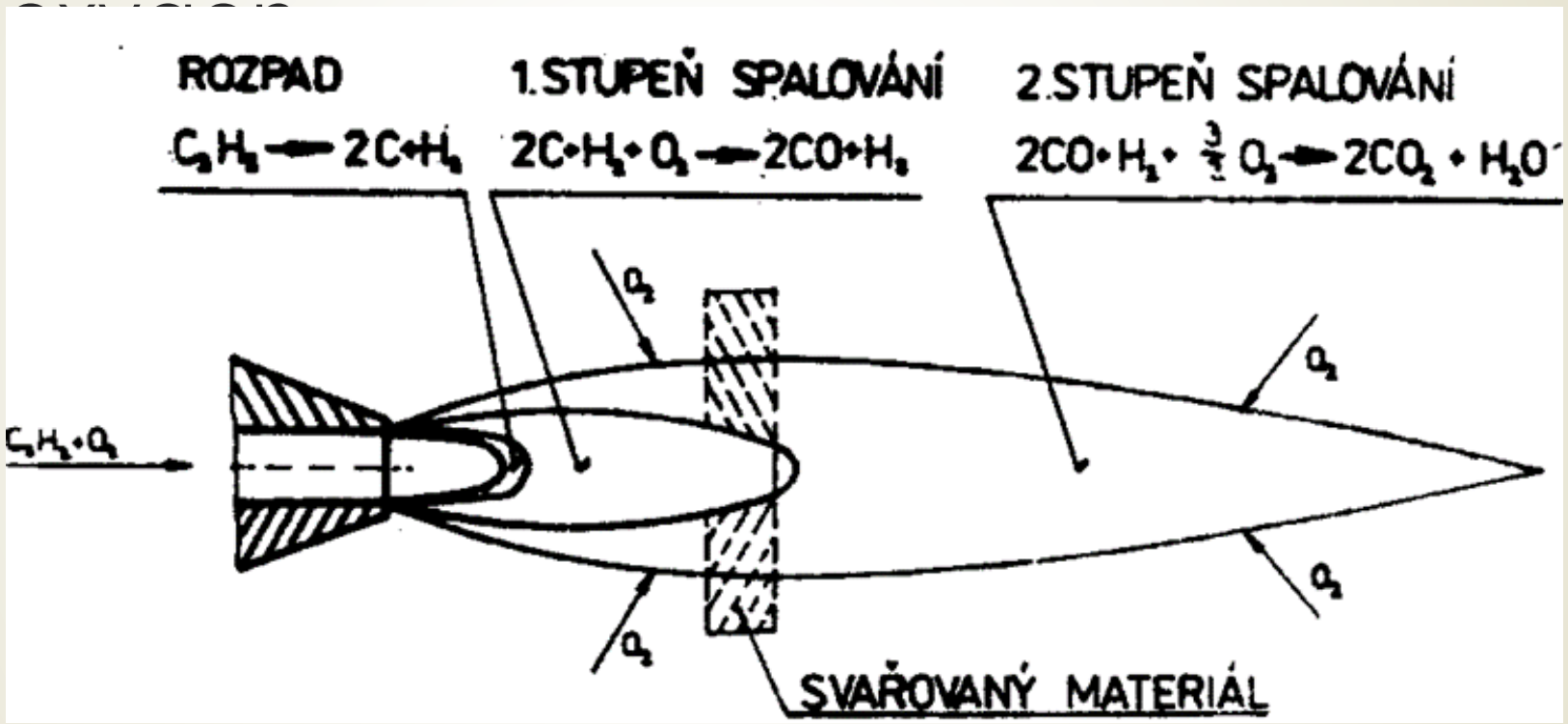
d) Using filled (tubular) electrode or doped using filler wire, which is or is not connected to the electric current.

e) Melting trap method 141.

Alloying weld metal during welding oxy-acetylénovým flame

- We weld metal during welding flame nalegovat used additive material in wire form which melt off in the weld pool.
- For alloy steel welding, we have to set up a neutral flame. The figure schematically shows a neutral flame shape, the individual regions, the stage of dissolution and degree of combustion of acetylene acetylene.

Acetylene decomposition and degree of combustion of acetylene in admixture with oxygen



KOUKAL, J., SCHWARZ, D., HAJDÍK, J. *Materiály a jejich svařitelnost.* 1. vyd. Ostrava: VŠB – Technická univerzita Ostrava, 2009. s. 43.

Alloying weld metal during welding oxygen-acetylene flame

- The burner must be placed at a distance corresponding to the hatched area in FIG.
- Weld Bath is then protected with a mixture of CO and H_2.
- There the oxidation of the alloying elements and the transition elements of the coefficient of the filler material to the weld metal is high.
- Can cause only a small increase in the hydrogen content in the weld metal.

Alloying weld metal during welding oxygen-acetylene flame

- If However, we set the flame with excess oxygen (oxidation), the weld pool has been in contact with free oxygen and a transfer coefficient of alloying elements of additional material into the weld metal should rapidly due to oxidation of the alloying elements reduced.
- At setting acetylene flame with excess (carburizing) would admittedly prevent oxidation of the alloying elements, but the weld metal should cheated carbon.
- that would increase the value Rm, Re HV10 weld metal with a simultaneous decrease in toughness values.

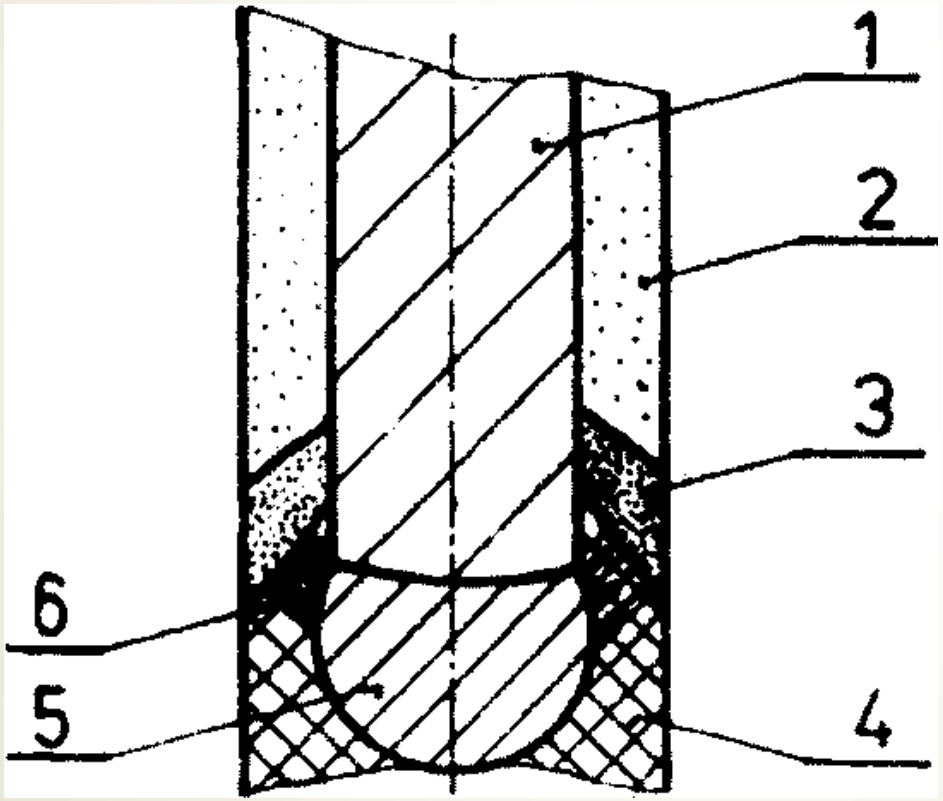
Alloying of weld metal when welding with coated electrodes

- Another method is the alloying metal when welding with coated electrodes.
- Yippee be alloyed core wire electrodes, the electrode casing or a combination of both.
- At Arcing at a firing end of the electrode crater, whose length depends on the melting of the different speeds of the core and shell electrode.
- On surface weld metal droplets produced metallurgical reactions taking place between the phases of the metal-slag-gas atmosphere, whose intensity depends on the temperature, viscosity and surface tension.

Alloying of weld metal when welding with coated electrodes

- It is best to use a basic alloying of the electrode casing, its neutral to a reducing atmosphere in the nature of the arc weld heavily alloyed transition metal elements from the slag.
- Place priority alloying the phase boundary of the weld metal drop-slag crater electrodes, as shown.
- Drop weld metal from the crater of the electrode to the weld pool alloying.
- Alloying weld metal molten slag from the base material, however, it has little significance.

Diagram alloying drops weld metal shell



1. *core electrode*
2. *packaging electrodes*
3. *sintered part of the package*
4. *slag*
5. *drop alloy weld metal*
6. *priority area alloying*

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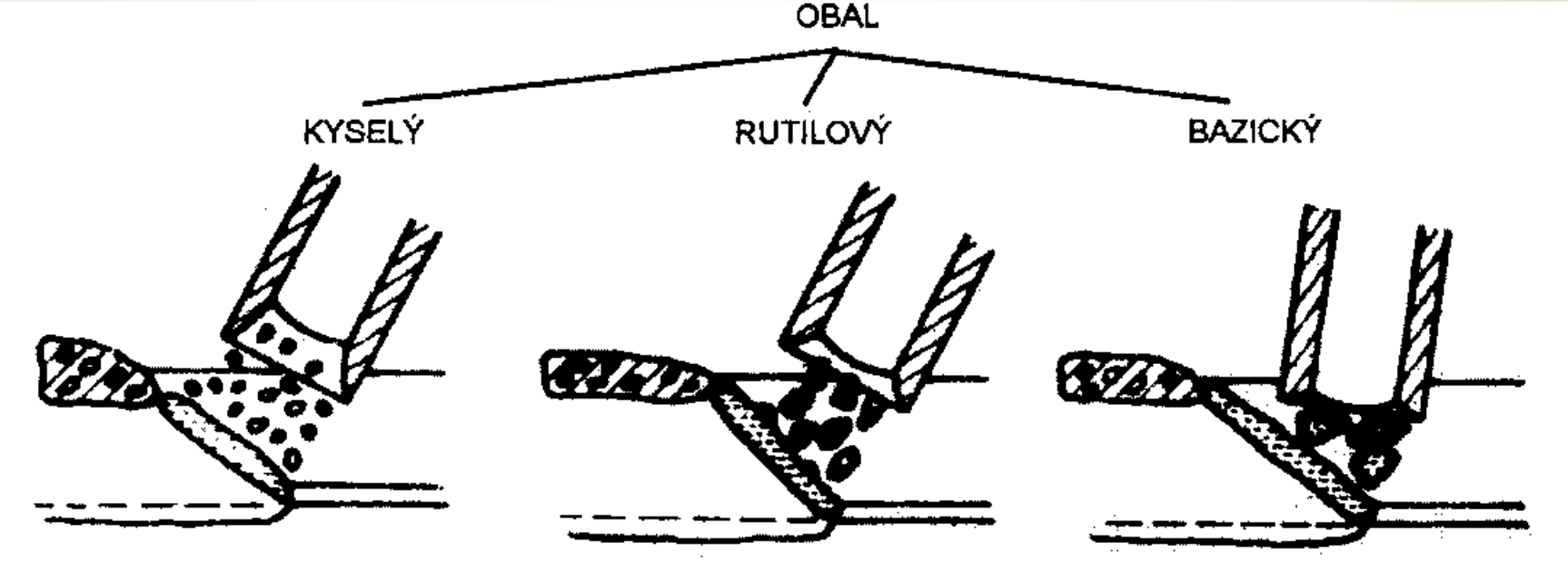
Distribution of coated electrodes by metallurgical effect on the weld

- Coated electrodes can be classified into several types that express the behavior of slag.
- Biggest technical importance electrodes are enveloped basic, rutile and acid.
- Each other differs weld metal droplet transfer from the electrode to the weld pool, penetration, slag properties and the quality of the weld metal, as shown in FIG.

Scheme droplet transfer from the electrode into the molten bath at acidic, rutile and basic electrodes



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Alloying of weld metal when welding machine Submerged

- Here, it is possible to weld metal nag an additional wire or tape, a flux, or a combination of both.
- The mechanism and the degree of alloy strongly depends on the nature and way of passage of the weld metal droplet cavern.
- there two basic different ways of transition weld metal cavern:
  1. After the cavern wall.
  2. Free passage cavern

Alloying of weld metal when welding machine Submerged

- In the former case drops flow down the weld metal along the wall of the cavern, i.e. the deposition rate until fusion of the molten weld metal base material.
- At cavern drop passage is in contact with molten slag.
- This process is enhanced by increasing the voltage on the arc, raising the bulk layer of the flux and slag using surfactants.
- Reaction the gas phase is negligible.

Alloying of weld metal when welding machine Submerged

- In the latter case, the droplet transfer of the weld metal is characterized in that the transition takes place without any significant contact with slag droplets.
- This transition process is supported by an increase in current strength.

For the alloying of the weld metal flux can not be used any type of flux.

Distribution of flux according to the method of their production

- melted,
- sintered (Sintered)
- ceramic.

melted flux

- It is a molten silicate, which, after solidification, forms an amorphous matrix.
- Folders to manufacture molten fluxes are manganese ore, silica sand, lime, magnesium oxide, kaolin and fluorspar.
- listed components are melted in the flame or electric furnace at temperatures between 1250 ° C to 1500 ° C in a similar manner as the glass matrix in the manufacture of glass.
- Content Folders are governed by the relevant technical regulations.
- After tapping grooves melt is fed into a water bath where it is granulated.
- Granulate is dried and graded according to grain size.
- Appearance these fluxes are glassy. Fused fluxes can not exceptMn economically and Si alloying the weld metal.

sintered flux

- They consist of oxides of iron and manganese carbonates, silicates, fluorides, ferroalloys like.
- Mixture is homogenized and then heated in a furnace at about 900 ° C, but may be higher.
- This the temperature is slightly lower than the melting temperature of the component with the lowest melting point.
- So a solid mass, which after cooling is crushed and graded according to grain size.
- Reaction between the components of the flux are made only partly, wherein the gaseous products are expelled.
- This flux can economically alloyed weld or weld metals.

ceramic fluxes

- Their composition is the same as having flux sintered.
- After homogenization of the mixture particles combined binder, which is usually water glass, sodium or potassium.
- After thorough kneading, this plastic mass is pressed through a nozzle of a certain diameter adjusted to the grain and dried up at 400 ° C.
- Also These fluxes are capable of alloying metals and weld surfacing.
- Pull also include magnetic flux.

Ceramic fluxes

- Fused fluxes are non-hygroscopic.
- Opposite that sintered and ceramic fluxes are strongly hygroscopic.
- to Welding may only be used dry flux.
- melted flux immediately before welding, dried at temperatures of 100 ° C to 300 ° C to get rid of surface moisture.
- sintered ceramic flux and dried at 400 ° C to 800 ° C when shedding of surface moisture and crystal bound water.
- some flux dried at still higher temperatures.

Alloying weld metal during arc welding in a protective atmosphere

- For methods shielded welding shielding gas has a role to protect the melting of the filler metal weld pool and the base metal from exposure to the atmosphere.
- Efficiency effect depends on the chemical nature, quantity and purity of the protective gas used but also on the welding parameters and welding conditions.

Alloying weld metal during arc welding in a protective atmosphere

- Method of TIG welding (TIG) and MIG working with chemically inert gases Ar, He and mixtures thereof.
- Metallurgical reactions take place only in the welding bath base material due to substances capable of reaction supplied by the weld puddle of molten base material and weld metal odtaveným of the filler wire.
- Weld metal can nag only additive material.
- If basic and filler materials contain increased amounts of oxidizing agents, the oxidation loss of alloying elements (burn) Is very low.
- Technology TIG and MIG are therefore suitable for welding alloy steel.

Alloying weld metal during arc welding in a protective atmosphere

- The resulting weld metal droplets are enriched with oxygen, which originated CO2 dissociation, and thus enriched drop passes into the weld pool base material.
- In the weld pool is oxygen cause further oxidation reactions, which could reduce both the strength and plastic properties of the weld metal.
- Additional Materials must therefore be overlaid with desoxidation elements especially elements Mn and Si that forms during desoxidation reactions with oxygen insoluble oxides in the weld metal and float to the surface of the molten bath as part of the slag.
- Over this measure the losses of alloying elements by oxidation (burn) high. Therefore it is recommended to use technology MAG with protective atmosphere of pure CO_2 welding alloyed steels.