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MODULE U

Oxygen cutting

Heat separation of materials



Heat division materials

- The materials can be prepared and thermal division, for which it is possible to use oxygen cutting.
- In practice using other ways of cutting - laser, plasma, etc.



Metal cutting oxygen

- Thermal regularly - cutting oxygen is based on the principle of iron combustion in an oxygen stream.
- Cut material is preheated to a neutral flame ignition temperature and then open the cutting oxygen stream, thereby burning the cut metal.
- Lane, where it is combusted material is very narrow, and thus gives the dimension of kerf.
- Oxygen pressure deflates the remaining slag, which remained on the edges of the kerf.



Conditions for metal cutting oxygen

- Metal-ignition temperature must be lower than its melting point.
 - This It satisfies a condition reliably alloy steel steel which has a reaction temperature of 1250 ° C and a melting point of 1530 ° C.
- The melting point of the metal must be lower than the melting point of the metal.
 - Oxides iron have an average melting point of about 1450 ° C, which is also satisfactory.
- Oxides formed to be thinly liquid, in order to easily remove the oxygen.
- Cut metal must have a high content of alloying elements increasing hardenability (Mo. Cr, W, Ni et al.), Or which prevent the cutting of high-melting oxides (Cr, Si, etc..).



Conditions for metal cutting oxygen

- ▶ Heat conductivity metal should not be too high.
- ▶ The amount of heat that is released during combustion must be sufficient to eliminate the heat loss and maintain a stable exothermic reactions.
 - ▶ At cutting carbon steel is obtained by reaction of iron and oxygen to 80% of the total heat and preheat flame to about 20%.
- ▶ Proof of the exothermic reaction, and during the combustion of iron oxygen lance in applications where, after ignition wires of nearly pure iron combustion reaction proceeds spontaneously.



Conditions for metal cutting oxygen

- In practice, ie., that the oxygen can only cut steel with low content of alloying elements, or carbon steel.
- Ignition the temperature ranges from 1050 ° C to 1300° C according to the content of carbon and other elements, melting point 1530° C.
- Non-ferrous metals, high-alloy steel and cast iron do not fulfill these conditions, and therefore, oxygen can not be cut.
- During combustion of 1 kg of iron is released about 4800 kJ of heat, which, together with the preheating is sufficient that the reaction continued spontaneously.
- Temperature melting the resulting slag is 1370°C to 1450°C is again lower than the melting point of the metal to be cut.



Conditions for metal cutting oxygen

- In cases of large thickness 500 mm - 2000 mm is cut with oxygen adding pure iron powder.
- Addition powder allows to cut hard materials with oxygen cuttable e.g. high-alloy steels, wherein the cutting edge covers a dense chromium oxide which prevents diffusion of oxygen into the steel.
- Thermal Flame power is dependent on the type of fuel gas and on the mutual mixing ratio.
- The most widespread heating gases for oxygen cutting are acetylene and propane (can use natural gas, butane and hydrogen).
- For cutting process speed is important combustion of fuel gas, which is the largest in the acetylene.
- At propane are also other mixing ratios.



The melting points of some oxides

type of	Melting temperature (° C)
FeO	1370
Iron oxide Fe_2O_3	1565
Oxide ferrous Fe_3O_4	1527
Manganese oxide MnO	1785
Chromium oxide Cr_2O_3	2265
Nickel oxide NiO	1990



Materials suitable for oxygen cutting

- Oxygen can be cut in all kinds of steel from unalloyed and low-carbon low-alloy steels to to about 1.6% C, because with increasing carbon content increases the ignition temperature and the melting temperature decreases.



Length of preheating time when using different combustible gases

The thickness of the cut material	Heating time (s)		
	Acetylene (C ₂ H ₂)	Hydrogen (H ₂)	Coal gas
20	6-7	10-12	10-14
50	9-10	14-16	18-22
100	15-17	18-22	22-27
150	25-28	22-27	23-33
200	30-35	28-33	35-42