Тема занятия: «Основные принципы сварки»

Цель занятия: выучить новый лексический материал по теме «Основные принципы сварки»; совершенствовать навыки чтения и перевода текста профессионального направления; систематизировать знания, ответив на контрольные вопросы по теме занятия.

Уважаемые студенты! Ознакомьтесь с материалами практического занятия на тему «Основные принципы сварки». Конспект занятия выполняйте **в рабочей тетради письменно**, **обязательно указывая дату занятия, тему занятия, номер упражнения.** Ответы предоставить преподавателю на проверку **до 21. 03. 2023 г.** в электронном виде **(фотоотчёт)** на e-mail mikagol2605@mail.ru. Телефон преподавателя для консультации и возникающих вопросов: 072-14-15-816.

С уважением, Голодюк Марина Викторовна.

1. **Запишите новую лексику в словарь, выучите новую лексику.**
2. **Прочитайте и устно переведите текст «Basic Principles of Welding».**
3. **Дайте письменно ответы на вопросы к тексту.**

Basic Principles of Welding

Vocabulary

coalescence – соединение, слипание; сращение
filler material – присадочный материал
molten pool – ванна расплавленного металла, сварочная ванна
gas flame – газовое пламя
solid-phase – твёрдая фаза
ultrasonic – ультразвуковой
friction – трение
furnace – печь
diffusion – 1) рассеивание ; 2) диффузия
high-current – сильноточный
low-voltage – низковольтный, низкого напряжения
discharge – разряд
arc column – столб дуги
direct current (dc) – постоянный ток
alternating current (ac) – переменный ток

layer – слой; пласт; ряд
molten-metal droplet – капля жидкого металла
flux – флюс
inert atmosphere – инертная среда
annulus – тех. узкое кольцо (зазор и т. п.)
torch – сварочная горелка (для автоматической сварки – головка)
base metal – основной металл
grain – зерно
precipitation – осаждение
residual stress – остаточное напряжение

A weld can be defined as **a coalescence** of metals produced by heating to a suitable temperature with or without the application of pressure, and with or without the use of a **filler material.**

In fusion welding a heat source generates sufficient heat to create and maintain **a molten pool** of metal of the required size. The heat may be supplied by electricity or by a **gas flame**. Electric resistance welding can be considered fusion welding because some molten metal is formed.

Solid-phase processes produce welds without melting the base material and without the addition of a filler metal. Pressure is always employed, and generally some heat is provided. Frictional heat is developed in **ultrasonic** and **friction** joining, and **furnace** heating is usually employed in **diffusion** bonding.

The electric arc used in welding is **a high-current**, **low-voltage discharge** generally in the range 10–2,000 amperes at 10–50 volts. An **arc column** is complex but, broadly speaking, consists of a cathode that emits electrons, gas plasma for current conduction, and an anode region that becomes comparatively hotter than the cathode due to electron bombardment. Therefore, the electrode, if consumable, is made positive and, if nonconsumable, is made negative. A **direct current (dc)** arc is usually used, but **alternating current (ac)** arcs can be employed.

Total energy input in all welding processes exceeds that which is required to produce a joint, because not all the heat generated can be effectively utilized. Efficiencies vary from 60 to 90 percent, depending on the process; some special processes deviate widely from this figure. Heat is lost by conduction through the base metal and by radiation to the surroundings.

Most metals, when heated, react with the atmosphere or other nearby metals. These reactions can be extremely detrimental to the properties of a welded joint. Most metals, for example, rapidly oxidize when molten. **A layer** of oxide can prevent proper bonding of the metal. **Molten-metal droplets** coated with oxide become entrapped in the weld and make the joint brittle. Some valuable materials added for specific properties react so quickly on exposure to the air that the metal deposited does not have the same composition as it had initially. These problems have led to the use of **fluxes** and **inert atmospheres**.

In fusion welding the flux has a protective role in facilitating a controlled reaction of the metal and then preventing oxidation by forming a blanket over the molten material. Fluxes can be active and help in the process or inactive and simply protect the surfaces during joining.

Inert atmospheres play a protective role similar to that of fluxes. In gas-shielded metal-arc and gas-shielded tungsten-arc welding an inert gas —usually argon—flows from **an annulus** surrounding the **torch** in a continuous stream, displacing the air from around the arc. The gas does not chemically react with the metal but simply protects it from contact with the oxygen in the air.

The metallurgy of metal joining is important to the functional capabilities of the joint. The arc weld illustrates all the basic features of a joint. Three zones result from the passage of a welding arc: (1) the weld metal, or fusion zone, (2) the heat-affected zone, and (3) the unaffected zone. The weld metal is that portion of the joint that has been melted during welding. The heat-affected zone is a region adjacent to the weld metal that has not been welded but has undergone a change in microstructure or mechanical properties due to the heat of welding. The unaffected material is that which was not heated sufficiently to alter its properties.

Weld-metal composition and the conditions under which it freezes (solidifies) significantly affect the ability of the joint to meet service requirements. In arc welding, the weld metal comprises **filler material** plus the **base metal** that has melted. After the arc passes, rapid cooling of the weld metal occurs. A one-pass weld has a cast structure with **columnar grains** extending from the edge of the **molten pool** to the centre of the weld. In a multipass weld, this cast structure may be modified, depending on the particular metal that is being welded.

The base metal adjacent to the weld, or the heat-affected zone, is subjected to a range of temperature cycles, and its change in structure is directly related to the peak temperature at any given point, the time of exposure, and the cooling rates. The types of base metal are too numerous to discuss here, but they can be grouped in three classes: (1) materials unaffected by welding heat, (2) materials hardened by structural change, (3) materials hardened by **precipitation** processes.

Welding produces stresses in materials. These forces are induced by contraction of the weld metal and by expansion and then contraction of the heat-affected zone. The unheated metal imposes a restraint on the above, and as contraction predominates, the weld metal cannot contract freely, and a stress is built up in the joint. This is generally known as **residual stress**, and for some critical applications must be removed by heat treatment of the whole fabrication. Residual stress is unavoidable in all welded structures, and if it is not controlled bowing or distortion of the weldment will take place. Control is exercised by welding technique, jigs and fixtures, fabrication procedures, and final heat treatment.

Answer the questions:

1. What is a weld?
2. How can the heat be supplied for welding?
3. Is pressure employed in solid-phase processes?
4. What does an arc column consist of?
5. How is heat applied during welding?
6. What is the role of inert atmospheres?
7. What can make a joint brittle while welding?
8. What does the weld metal comprise in arc welding?
9. What is the base metal influenced by?
10. How can residual stress in welded structures be controlled?