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Erasmus+ Programme
of the European Union



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MODULE A

Introduction to the problems of welding

Producing a weld joint for metallic materials



Formation of metal weldment materials

- ▶ Undetachable weld seam of metal materials is formed so that the bonding surfaces are brought together at a distance r_0 , which corresponds to the metal crystal lattice parameter of the metal which it connects.
- ▶ At welding of steels, it is the distance corresponding to the lattice parameter of iron or γ ie lower than 1 nm (~ 0.286 nm).
- ▶ Today's methods still do not allow processing of metals such accuracy that would allow approach places all machined surfaces at a distance corresponding to the lattice parameter associated metals.
- ▶ Therefore may apply interatomic bonds only at individual points of the surfaces.
- ▶ Therefore Also the strength of the joint would be negligible compared to the strength of metals bonded.



Producing a weld joint for metallic materials

- ▶ For bonding of the material it is necessary to deliver these materials such activation energy that increases the amplitude of the amplitude of the metal ions in the lattice, or even released metal ions from solid equilibrium positions in the lattice, and thus allow them to reach a distance corresponding lattice parameter and thereby a welded joint.
- ▶ The required activation energy can generally be awarded:
- ▶ Temperature - raising the temperature of thermal activation occurs.
- ▶ Elastic and plastic deformations - causes a considerable number of failures at interfaces - mechanical activation.
- ▶ Electron or ion radiation - radiation activation.



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- ▶ During welding, the hitherto most widely used thermal or mechanical activation welded surfaces, or a combination thereof.
- ▶ If will be used for producing a welded joint by thermal activation only to the extent that both surfaces and filler material melts, we speak of fusion welding (zero pressure).
- ▶ If We will only use mechanical activation welded surfaces it comes to welding, cold pressure (to create the necessary connections are very high pressures and can thus only very weld plastic materials - eg. Al, Cu).



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- ▶ Much more common is the use of the same time thermal and mechanical activation of the welded surfaces.
- ▶ Confiteor the seal but not melting of the joined materials.
- ▶ TechnologyWherein the joint is formed on this principle is called pressure welding technologies.
- ▶ Radiation Activation of welded or soldered surfaces is not a new principle to create a weld.
- ▶ It is the new way of heating the material to the welding or soldering temperature.
- ▶ Very fast and very "clean" heating (without byproducts, electric and magnetic fields) is achieved by heating the surface or leave electron impact ion irradiation.



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- ▶ Welded or soldered materials are placed in the focal point metal elliptical or parabolic mirrors.
- ▶ That results in a very large amplification of the intensity of the incident radiation and the heating is greatly accelerated.
- ▶ Help the intensity of the incident radiation and the time that light turns out, we can very precisely metered heat needed to create connections.
- ▶ This heating principle is currently used for soldering in electronics special parts and missile technology.
- ▶ Equipment welding materials are currently being developed.