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# MODULE 5

## Special methods of fusion welding

Ultrasonic welding



# Ultrasonic welding

- ▶ This welding process uses a welded joint mechanical vibrations of high frequency - ultrasound.
- ▶ Source vibrations consists of an ultrasound transducer whose coil is fed by an electronic high-frequency generator at a frequency of 4 kHz to 100 kHz.
- ▶ Own oscillator consists of a magnetostrictive transducer (alloy Fe + Ni Fe + Co + V) or a piezoelectric transducer (titanate, barium, zirconium titanate lead), to which is attached a funnel-shaped waveguide amplifying the amplitude of oscillation.
- ▶ waveguide It is finished so. sonotrode which transmits the oscillation of the welding material.

KUBÍČEK, J. DANĚK, L. KANDUS, B. *Technologie svařování a zařízení. Učební texty pro kurzy svařovacích inženýrů a technologů.* Plzeň: ŠKODA WELDING, s. r. o., 2011. s. 166.



## Ultrasonic welding

- ▶ Sonotrode they are pressed by a force, which ensures the transmission of ultrasonic vibrations to the bond site.
- ▶ Oscillation it is transmitted to the interface of the two bonded materials, where the plastic deformation of metal and the relatively small increase in temperature.
- ▶ In it is currently used devices using longitudinal, bending and torsional vibrations. Beginning welding is characterized by the interaction of pressure and vibration, which occurs first violation oxide the layer aligning the surface roughness and removal of contaminants at the site of the future joint.
- ▶ In next phase seam forming plastic microdeformation and diffusion at relatively low temperature at the contact surface.

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# Ultrasonic welding

- ▶ The actual chemical bonding joint when approaching the surface at a distance of action of interatomic forces, when local binding sites are formed between the joined materials.
- ▶ Conveniently They are welded materials with cubic face centered lattice - Al CuNi, Co etc., which are characterized by very good plasticity.
- ▶ Optimal weld amplitude is between 5 microns and 35 microns.
- ▶ At creates large amplitudes makroskluz, Severe plastic deformation and friction intensive generates large heat.



## The main welding parameters

- ➔ Displacement amplitude sonotrode [Mm]
- ➔ The thrust force [N]
- ➔ The frequency of the ultrasound waves [Hz]
- ➔ Welding time [sec]



## The main welding parameters

- ▶ Type ultrasonic device determines the oscillation frequency, which ranges from 10 kHz to 100 kHz.
- ▶ Characteristic are very short welding times ranging 3 - 6 sec. The thrust force moves the values 0.4 MPa to 1.2 MPa.
- ▶ The temperature on the contact surfaces can reach up to 60% of the melting temperature of the weld metal.



## Weldability

- ➔ In this way better than pure metals welded metal alloy.
- ➔ Weldability weldability is similar cold pressure.



## Using ultrasonic welding

- ➔ It is used mainly in electrical engineering and electronics.
- ➔ My found its application in aviation and space technology, preferably in this way are welded and plastics.





## Safety in ultrasonic welding

- ▶ The worker must beware of burns, safety rules are similar to those at work on the presses, they are subject to high compressive strength and the worker must avoid contact to the oscillating parts of the device, do not touch and welded material.