Óbuda University

Bánki Donát Faculty of Mechanical and Safety Engineering

Institute of Material Science and Manufacturing Engineering

Electromagnetic metal forming

http://www.bgk.uni-obuda.hu/~aat/

Electromagnetic forming, which belongs to the group of electro-dynamic forming processes, has been developed for sheet or tubular work pieces of good electrical conductivity and low yield strength metals. It is carried out with high energy rate electromagnetic pulse, and without any mechanical or hydraulic contact.
One of the most important application fields of electromagnetic forming is plastic metal forming. The forming force is created by the magnetic field acting on the work piece, so there is no need to use a traditional tool for forming, and it can be performed without any contact of the surface. In the case of tubes and hollow profiles both the compression or expansion methods of electromagnetic forming are applied. The forming can be carried out as a so-called free forming, but for the most work pieces to be produced a die is required, which can be a core (compression tube forming) or a shaped ring (expansion tube forming).
Besides direct shaping there are other application areas as well, so electromagnetic plastic forming is a potential field of creating joints between tube and rod-like components. Connecting components of dissimilar materials is an increasing demand in the manufacturing process of structures in the automotive industry. The application of new technologies, such as electrodynamic, especially electromagnetic forming, is a possible method to satisfy these demands.
The newly developed form-fit joints, having both, axial and radial grooves, appeared to withstand not only tensile but also torsion load. The tensile and torsion strength of aluminium tube and rod joints with one radial and three axial grooves have reached the corresponding strength of the tube material.

Infrastructure

- CSM Micro-Hardness tester
- Scanning Electron Microscope
- LD-DYNA software
- Optical microscope
- Electrodynamic forming equipment

Related projects

- **Project works**
  - Technological and die design of electrodynamic forming processes
  - Electromagnetic forming of tubes
  - Electromagnetic forming of tube-rod joints; interference-fit and form-fit joints
- **Diploma works for B.Sc.**
  - Form-fit joints made by electromagnetic forming

Modelling of electromagnetic forming by FEM

Partners

- S-Metalltech Materials Research and Development Ltd, Budapest, Hungary
- Kecskemét College, Hungary

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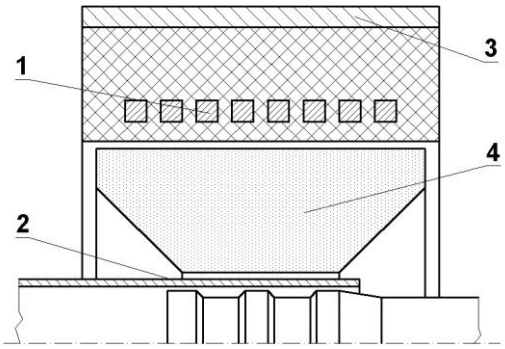
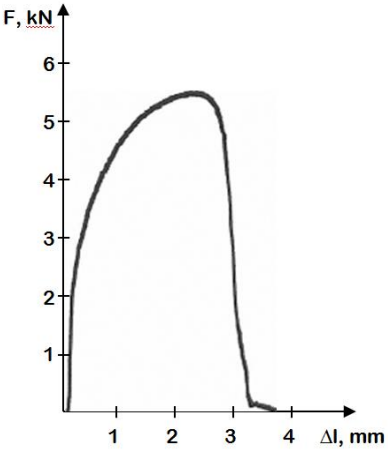


Fig. 1 Compressive electromagnetic forming tool with field shaper
(1-coil, 2-workpiece to be formed, 3-metal casing, 4-field shaper)



(a)

(b)

Fig. 2 Tensile test diagram of a joint (a) and a joint after fracture (b)

Fig. 3 Joints deformed and fractured by torque