Measuring the toughness of weld joints on a tensile test machine.

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In the tensile strength of weld joints, the sample breaks at the point of least strength or at the point of the defect. If there is a fracture of the basic material, we do not get an overview of the strength of the individual parts of the weld joint [1]. For that reason a shear test have been developed. This process implies that it would be possible to measure shear strength and toughness in butt welds of base materials, in different places of the heat affected zone, in weld metal. Mechanical properties of the welded joint can be characterized by determination of strength and from the force-displacement dependence by the toughness. Shearing in predetermined part of the welded requires fixation of the sample in the required position using a holder. This causes that it is not possible to determine the specific shear energy for samples with different shear areas. Fracture energy consists of two components - shear energy and rupture (final failure) energy. Shear energy is related to the deformation properties of the joint - the energy of deformation until the joint deforms and a crack does not appear, that is, it is related to the resistance to crack formation, the fracture energy to the resistance to crack propagation [2]. The fracture in the shape of the S curve subsequently causes a decrease in the gradient of the decrease in force by mutual friction with the created surface, which increases the value of the measured fracture energy. Therefore, it is possible to exactly determine the energy only up to the maximum value of the force. In the shear test a special device with universal testing machine was used. For accurate force measurement, the strain gauge force sensor of the universal testing machine was calibrated using an externally calibrated strain gauge pressure sensor.

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[2] C. Leitão, M.I. Costa, K. Khanijomdi, D.M. Rodrigues, Materials & Design 51 (2013).