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STRESS-STRAIN STATE OF ASSEMBLIES OF THE CYLINDRICAL SHAPE IN DIFFUSION BONDING

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The stress-strain state of assemblies of the sleeve--flange type, made from dissimilar materials by diffusion bonding, and regularities in formation of this state were studied by finite element computer modelling, allowing for the effect of plastic strains.

Keywords: *diffusion bonding, sleeve--flange assembly, dissimilar materials, stress-strain state, computer modelling, plastic strains*

Components of a cylindrical shape, made from dissimilar materials by diffusion bonding, are often used in machine building. Study [1] considers the stress-strain state (SSS) of assemblies of the cylinder--cylinder and sleeve--sleeve types in diffusion bonding. It is shown that under force and thermal loading the level of stresses within the bond zone dramatically changes even when the parts bonded have the same diameters. Bonding the sleeve--flange type cylindrical parts of different diameters leads to formation of a stress raiser in the sleeve-to-flange transition zone, which may have a substantial effect on SSS of the bond and its formation.

The purpose of this study was to investigate SSS of the sleeve--flange assemblies within the bond zone in diffusion bonding.

Modelling of SSS was carried out allowing for the effect of plastic strains. It is reported [2] that plastic strains can be subdivided into time-independent strains (instantaneous plasticity) and time-dependent ones (creep). The present study investigates instantaneous plasticity strains. Modelling of SSS within the elasticity theory frames is considered in study [3].

Investigations were conducted by the computer modelling method using software package ANSYS. Mises condition $\sigma_{eq} = \sigma_y$, where σ_{eq} are the equivalent (reduced) stresses, and σ_y is the yield stress, was taken as a criterion of formation of plastic strains. Results of the present study were compared with those obtained in study [4] dedicated to modelling of SSS in diffusion bonding of cylindrical parts containing no design stress raiser.

The investigations were carried out on the sleeve--flange bond samples and computation model (Figure 1). Variants of the combinations of materials properties are given in the Table. The strengthening modulus in plastic deformation for all materials was assumed to be equal to zero, except for model 1, where it was assumed to be equal to $1\cdot10^3$ MPa to provide stability of the solution.

The results of solving the plastic problems were compared with those of solving the elastic problems.

In model 1, loading was applied according to the classic scheme of diffusion bonding, i.e. uniform com-

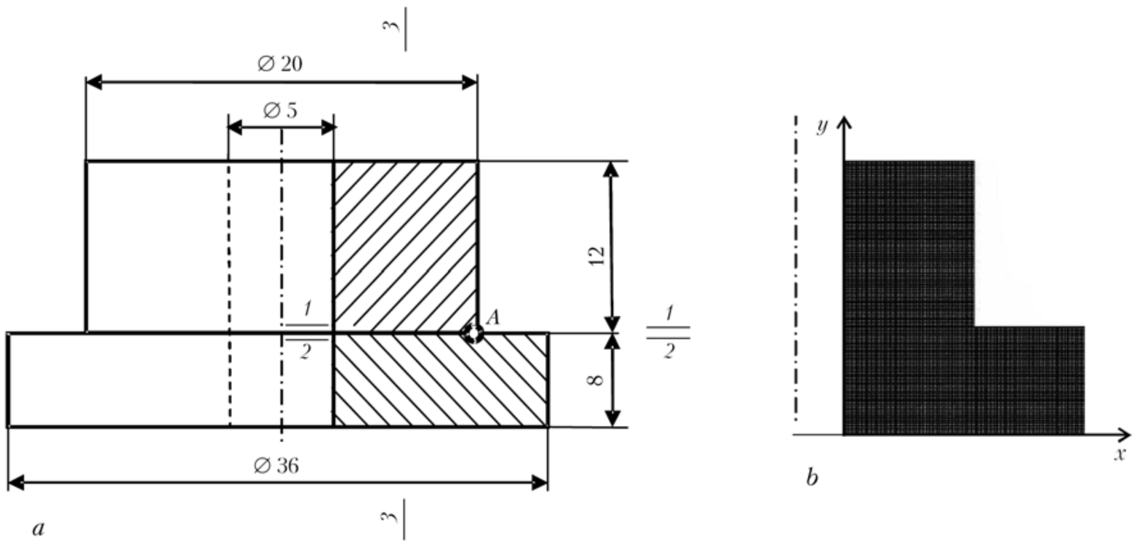

Figure 1. Schematic of the sleeve--flange assembly bond (*a*) and sections of finite element model (*b*)