

Design and production specifics of variable-thickness sheet metal workpieces for aircraft part drawing

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The article presents guidelines for designing and manufacturing variable-thickness disk-shaped workpieces made of sheet metal that ensure more uniform thickness of drawn parts. The novelty of our investigation results lies in describing variations in wall thickness and height of cylindrical parts as functions of geometrical parameters of these disk-shaped workpieces, the thickness of which decreases towards the edge. Our study simulated the drawing process numerically using the DEFORM software package. We determined the limiting drawing ratio by solving the differential equation of equilibrium for the flange of a variable-thickness disk-shaped workpiece. We established that workpieces characterised by a linear thickness variation function make it possible to compensate for increases in flange thickness during drawing of parts, making the resulting part thickness more than 3 times more uniform. We show that disk-shaped workpieces characterised by a linear thickness variation function enable manufacturing of parts featuring walls that have both constant and decreasing thickness. In order to reduce the number of drawing operations we suggest using disk-shaped workpieces characterised by linear, parabolic and logarithmic thickness variation functions. We recommend manufacturing variable-thickness disk-shaped workpieces by machining them pre-strained.

Keywords: *disk-shaped workpiece, limiting drawing ratio, non-uniform thickness, work-piece edge thickness, thickness variation function*

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