

Drawing of Hexagonal Shapes from Cylindrical Cups

Dr. Waleed Khalid Jawed

Metallurgy & Production Engineering Department, University of Technology /Baghdad

Email: Drwaleed555@yahoo.com

Sabih Salman Dawood

Metallurgy & Production Engineering Department, University of Technology /Baghdad

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ABSTRACT

The main aim of this work is design and manufacturing cylindrical and hexagonal dies to produce hexagonal cups from transform the cylindrical cups to hexagonal cups and affect of wall corner radii of die. As well as using some parameters which effect of on the hexagonal deep drawing process, especially on the punch force, strain distribution and variation of the cup wall thickness for three stages such as (wall corner radius of die and punch speed). 3-D models of cylindrical cups of (43 mm) outer diameter, and diagonal and side distance of hexagonal cups are (41 and 36 mm) respectively, (0.7 mm) thickness made from low carbon steel (1006–AISI), has been produced. A commercially available finite element program code (ANSYS11.0), was used to perform the numerical simulation of deep drawing operation. Two types of wall corner radii of die ($R_c=0.7, 4$ mm) with constant punch profile radius equal to ($R_p=4$) mm and die profile radius equal to ($R_d=8$ mm), various drawing speeds equal to (50, 200, and 500 mm/min) were used. From the numerical and experimental results of drawing operation, it, the maximum thinning occurs at cup corner radius when used wall corner radius of die equal to ($R_c=0.7$ mm). The best strain and thickness distribution over all zones in produced cup obtained when using wall corner radius of die is equal to ($R_c=4$ mm) and High drawing speed ($v=500$ mm/min) leads to increase drawing force and more thinning in cup corner.

Keywords: Deep drawing hexagonal cup, strain distribution, wall corner radius of die.