

Analysis of Axi-symmetric forging of a disk

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1. Quiz-Key

1. What is bulging? How does it affect the forging pressure?

Bulging is non-homogeneous deformation of a billet under upset forming, wherein the material at central plane flows more easily than material at the die-work interface, due to interface friction. Bulging may enhance the forging pressure due to redundant deformation.

2. A disk of initial diameter of 30 mm and height of 50 mm is hot upset to a final diameter of 40 mm. What is the final height of the disk? What is the maximum forging pressure if the yield strength of the material of disk is 100 MPa with $n=0$. Assume $\mu = 0.35$.

Solution:

To find the final height we can equate the initial volume of the disk to its deformed volume.

$$h = 28.13 \text{ mm}$$

We know that the forging pressure with sticking friction is:

$$p = Y e^{\frac{2\mu(R-r)}{h}}$$

The forging pressure is maximum at the centre, namely, $r = 0$.

Therefore,

$$p_{\max} = 164.5 \text{ MPa}$$

3. Two solid cylinders are of equal diameter but of different heights. They are subjected to axial upsetting. If both of them have undergone the same percentage height reduction, show that the final diameters will be the same.

Given that the percent height reduction is same.

i.e. $h_o/h_f = \text{same}$ in both cylinders. We can write for constant volume during deformation,

$h_o/h_f = d_f^2/d_o^2$, therefore, we have the final diameters equal.