ABSTRACT

In this thesis, a general problem on open die axisymmetric extrusion forging, consisting of a flange and an annular projection is analysed. Theoretical analyses have been made to predict the average pressure and compound metal flow in the process. The dependence of average pressure of extrusion forging and metal flow on friction and on the geometric parameters viz. width of annular die cavity, radial position of the cavity and the thickness of the workpiece are analysed. Experiments have been conducted to substantiate the theoretical predictions. A few particular cases of the general problem have also been studied.

Theoretical analysis has been done by using the upper bound approach. The analysis suggests three modes of metal flow in the process. For a particular configuration of billet size, die geometry and friction condition any one of the three situations may occur. If a relatively thick billet is compressed between two flat dies, one of which contains an annular cavity, the material below the extrusion cavity will pass through the three stages in sequence i.e. the total thickness of metal below the extrusion cavity (i) decreases (ii) remains almost constant and (iii) increases or extrusion occurs through the cavity. A computer program has been developed to predict the relative amount of metal flow in radial and axial directions at any stage of deformation during the process.

The upper bound approach is extended to analyse the cavity phenomenon which causes depression on the bottom face of extrusion forged component opposite to the projection. The analysis predicts the initiation and growth of cavity in the process.

Slab method has been used to analyse a closed die extrusion forging process associated with the edge-forming (coining) operation. The analysis predicts the coining load to obtain sharp edge on the extrusion forged component.