

THE FINAL ELEMENTS ANALYZE OF THE ACCUMULATED ROLLING WITH DIFFERENT NUMBER OF SHEETS IN THE PACK

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Annotation

Results of the final elements analyze of research formability and the stress-strain state by the accumulated rolling of two-layer and four-layer pack are presented.

Introduction

Growth of quality of production metal is more and more actual task. The wide circulation was found by methods of several plastic deformation. To such methods the accumulated rolling treats with connection [Krallics, Lenard, 2004] which is close to the technological scheme of multi-cycle package rolling.

The scheme of realization of rolling by ARB method the following: two leaves with the cleared and fat-free surface put in a package which after preliminary heating (up to the temperatures there is lower than temperatures of recrystallization) is rolled with single sinking not less than 50% for providing connection (svarivaniye) of separate layers. Then the received strip consisting of two welded layers is cut on two parts which connected parties clear, put in a package, heat and again roll. Process is repeated up to achievement of the set number of the cycles of rolling. Such method of rolling provides achievement of high values of deformation (>6-8) for creation of fine-grained structure [Valiev, 2009; Stefano, 2012]. Studying by method of final elements of process of the accumulated rolling with connection for two-layer and four-layer packages was the purpose of the real research.

Materials and methods

For analyze the final elements method (FEM) in the program DEFORM-3D complex is used. Three-dimensional models of preparation and working rolls were for this purpose constructed. Billet material – 1100 aluminum. In the course of simulation carried out hot rolling of two-layer and four-layer packages from 50% sinking of initial preparation.

Results and discussion

FEM analyze allowed to estimate forming of billet by ARB, and to study the stress-strain state. At realization of hot rolling by ARB method to 50% sinking of two-layer billet there is a formation of the favorable stress-strain state. The maximum value of the maximal principal stress makes 80,2 MPa, this stress is concentrated generally in areas of the billet located in the deformation center. Inter principal stress has nature of distribution similar to the maximal principal stress. The maximum value makes 50,4 MPa. The minimal principal stress is negative. Average mean stress is presented by generally squeezing stress which is formed in the deformation center. Values of stress effective are made by 48,8-65 MPa. At a billet exit from a deformation localization zone stress effective gradually decreases to 0 MPa. Strain effective is non-uniform. In regional zones strain effective reaches

1. In peripheral areas of billet damage reaches 0,625 that can cause emergence of cracks. After deformation of border of contact of sheets almost completely are absent. In general, the stress-strain state is formed at 50% sinking will allow to receive fine-grained structure.

Results of simulation of more hotly accumulated rolling of four-layer preparation with 50% sinking showed that at ARB the squeezing stress that will provide fining of structural components by deformation.

Distribution of stress coincides with distribution of stress by rolling two-layer billet. The maximum value of the maximal principal stress makes 224 MPa. . Inter principal stress has the maximum value of 137 MPas. Minimal principal stress is negative. Average mean stress is presented by generally squeezing stress which is formed in the deformation center. Values of stress effective are made by 97,5-114 MPa. Strain effective by rolling four-layer billet, also as well as rolling two-layer is non-uniform. In peripheral areas of billet damage reaches 0,622 that can cause emergence of cracks. In general, the deformed state which is formed at 50% deformation of four-layer billet will also provide refining of structural components at deformation.

Conclusion

During researches by FEM analyze it is revealed that in the course of ARB there is a formation of the favorable stress-strain state. There is a connection of the rolled sheets. Thus use of a four-layer package leads to growth of values of the stress in billet. Damage is at one level.