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Modeling of Cold Tube Drawing with a Fixed Plug by Finite Element Method and Determination of Optimum Drawing Parameters

Authors : E. Yarar, E. A. Guven, S. Karabay

Abstract : In this study, a comprehensive simulation was made for the cold tube drawing with fixed plug. The cold tube drawing process is preferred due to its high surface quality and the high mechanical properties. In drawing processes applied to materials with low plastic deformability, cracks can occur on the surfaces and the process efficiency decreases. The aim of the work is to investigate the effects of different drawing parameters on drawing forces and stresses. In the simulations, optimum conditions were investigated for four different materials, Ti64Al4V, AA5052, AISI4140, and C365. One of the most important parameters for the cold drawing process is the die angle. Three dies were designed for the analysis with semi die angles of 5°, 10°, and 15°. Three different parameters were used for the friction coefficient between die and the material. In the simulations, reduction of area and the drawing speed is kept constant. Drawing is done in one pass. According to the simulation results, the highest drawing forces were obtained in Ti64Al4V. As the semi die angle increases, the drawing forces decrease. The change in semi die angle was most effective on Ti64Al4V. Increasing the coefficient of friction is another effect that increases the drawing forces. The increase in the friction coefficient has also increased in drawing stresses. The increase in die angle also increased the drawing stress distribution for the other three materials outside C365. According to the results of the analysis, it is found that the designed drawing die is suitable for drawing. The lowest drawing stress distribution and drawing forces were obtained for AA5052. Drawing die parameters have a direct effect on the results. In addition, lubricants used for drawing have a significant effect on drawing forces.

Keywords : cold tube drawing, drawing force, drawing stress, semi die angle
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