Abstract

The doctoral thesis is devoted to the development and analysis of the rolling process of EN AW-6082 aluminium alloy rings using an innovative laboratory rolling mill equipped with a tilting forming mandrel. The aim of the work was to determine the influence of the mandrel tilt angle on the process, rolling stability and the geometric and material properties of the rings obtained. The methodology developed included FEM numerical simulations, laboratory experiments and microstructure and hardness analyses. The results of the research showed that a moderate inclination of the mandrel (approx. 2°) and its oscillatory movement promote uniform material flow, reduce the risk of process instability and lead to rings with a homogeneous microstructure and stable dimensions. Too large an angle of inclination caused loss of tool contact continuity and local deformations. The developed rolling mill enables precise control of process parameters and demonstrates a new technology for rolling light alloy rings. The research results are of cognitive and practical importance, opening up opportunities for the implementation of the technology in the aerospace, automotive and engineering industries.