

Abstract

Technological development and changing industrial needs pose constant challenges for manufacturers in relation to the production of products with increasingly better functional properties from difficult-to-form materials, such as CuBe2 beryllium bronze.

This paper is a comprehensive study of the process of drawing ultra-thin tubes from CuBe2 alloy. It covers both the technological basics and detailed results of experimental research, including a comparison with mathematical modeling of these processes. The paper describes the phenomena occurring during material deformation and discusses the material used for testing, its chemical composition, and physical properties resulting from previous processing. The following chapters present the drawing technology, focusing on tool geometry, drawing speed, temperature, and selected lubricants. One of the key issues is lubrication – its role in reducing deformation resistance, preventing surface damage, and its impact on drawing efficiency, which plays a key role in terms of production cost-effectiveness. The author discussed in detail the rheological properties of the lubricants used, indicating how viscosity, flow, and thermal reactions (analyzed using the TGA method) affect the process.

The rest of the paper focused on the analysis of mechanical parameters, which were shaped by changes in process parameters: lubricant type, tool geometry, and drawing speed. The influence of these variables on the surface quality of ultra-thin tubes, including surface roughness and changes in mechanical properties, was taken into account. The results of material tests included measurements of hardness, tensile strength, yield strength, and total elongation.

The final chapter of the dissertation discusses the mathematical modeling of the CuBe2 alloy tube drawing process. The model parameters were verified on the basis of industrial drawing tests, which allows us to conclude that the drawing process simulations can be used in the development of new technological processes at the WIKA Polska SGF Tube Competence Center. The author emphasizes that the integration of experimental results with numerical modeling is the key to optimizing the processes under study.