

# EXPERIMENTAL ANALYSIS OF INFLUENCE OF DIFFERENT LUBRICANTS TYPES ON THE MULTI-PHASE IRONING PROCESS

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## Resume

This paper is aimed at presenting results of an experimental analysis of the different types of lubricants influence on the multi-phase ironing process. Based on sliding of the metal strip between the two contact elements a special tribological model was adopted. The subject of experimental investigations was variations of the drawing force, contact pressure and the friction coefficient for each type of the applied lubricants. The ironing process was conducted in three-phases at the constant sliding velocity. The objective of this analysis was to compare all the applied lubricants in order to estimate their quality from the point of view of their applicability in the multi-phase ironing process.

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## 1. Introduction

The ironing process in cold conditions is frequently characterized by high contact pressures and local load of the tool, especially in the case of the multi-phase process. In such conditions, the lubricant has the decisive influence on plastic forming. Absence of lubricant would cause the direct contact of the machined piece and the tool, what would significantly disrupt the stability of the forming process. Lubrication, as a measure of reducing the damaging influence of friction, enables increase of the deformation and deep drawing degree, [1]. Application of lubricants eliminates or decreases the harmful phenomenon of galling [2], wear of the tool's working surfaces and improves the quality of the machined piece surfaces.

Based on the adopted tribological model, [3, 4], the original device was developed, based

on sliding of the thin sheet samples between the side elements (die) in three phases. The contact surfaces between the sample and the die were separated by the layer of lubricant. The three types of lubricants were applied: a) lubricant in the form of the zinc phosphate coating with oil, b) lubricating grease based on molybdenum-disulphate and c) oil for deep drawing. For each type of lubricants and the blank holding force, the measurement of the drawing force was performed.

Investigation of lubricants in ironing process represents a very interesting subject for research, what can be concluded based on numerous papers being published on this topic. Andreasen et al. [6] were investigating several types of lubricants by application of a model that simulates the ironing process. In their tests were applied variable process parameters like the speed, walls thinning value, step length and









