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RESEARCH

Different Ways of Friction Coefficient Determination in Stripe Ironing Test

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A B S T R A C T

The sheet metal stripe ironing laboratory test has been developed to study tribological appearances and performance of lubricants in ironing process. Most common way for friction coefficient determination in the test is use of different equations which gives relation between active forces and reactive friction forces. In application of such equations some difficulties occurs because of improper friction coefficient values, especially at small intensities of tensile or drawing forces. In this paper for literature an approach were analyzed and after that defining of new equation was proposed. New equation was tested numerically and experimentally. Obtained results indicated that the suggested improvement gives much more acceptable values of friction coefficient. That fact is particularly significant in lubricant evaluation process.

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1. INTRODUCTION

Ironing is technological process which combines characteristics of sheet metal forming and bulk forming. Thinning strains reach over 25 %, and contact pressure over 1000 MPa [1]. Most often applies in manufacture of cylindrical geometry pieces whose depth is much bigger than diameter, and bottom thickness is bigger than wall thickness.

Ironing is normally applied following deep drawing (or extrusion) when forming high, thin walled cans. Such cans are used for beverages, cartridge cases, high pressure cylinders, housings for pumps and shock absorbers etc. World annual production (especially for beverage cans) is more than billion pieces [2].

Of the sheet metal forming processes, ironing is one of the tribologically most severe, owing to the high surface expansion and normal pressure at the tool-workpiece interface. This is particularly significant in the case of forming of pour formability materials such as stainless steel, high strength steel, etc. [3]. Because of that, use of proper performance lubricants is very significant [4-5]. In order to quantify the performance of the individual lubricants, a different simulative test method has been developed. All the tests are modeling the process conditions in ironing. It is a very convenient to use coefficient of friction at contact surfaces change as a criterion for lubricants evaluation.

For this study one of classic stripe ironing tests was chosen [6]. By analysis of acting of drawing