Mayourshikha Pancholi. International Journal of Engineering Research and Applications
www.ijera.com
ISSN: 2248-9622, Vol. 10, Issue 6, (Series-VIII) June 2020, pp. 66-71

RESEARCH ARTICLE OPEN ACCESS

"Development of Circular Ring Specimens for Friction Determination in Metal Forming Process by Using Experimental Testing"

Mayourshikha Pancholi (Bhatnagar)
Lecturer in Manufacturing Department, Govt. polytechnic, Agar Malwa

ABSTRACT
The fundamental target of this examination is to discover exchange example for grinding assurance, and build up their grating alignment bend. Aftereffect of these bends is contrasted and ring pressure test. The consequence of this examination shows that such elective examples may assume significant job in grating assurance without ring example. It is seen that the geometry of those examples which comprise any geometrical shape inside circle give exceptionally close grating qualities.
Keywords: *Friction Coefficient, Metal Forming Process, Ring Compression Test*

Date of Submission: 13-06-2020 Date of Acceptance: 29-06-2020

I. INTRODUCTION

Rubbing is characterized as the protection from the relative sliding between two bodies in contact under a typical burden. Metal working and assembling process are fundamentally influenced by grating, as a result of the relative movement and the power present between device passes on, and work pieces. Grating effectsly affects both the work pieces and procedure factors, for example, twisting burden, metal stream, surface quality and inside structure of the item in metal shaping procedures. In this way, the interface grating must be comprehended and control. For viable grating control, impacts of the disfigurement procedure factors, for example, twisting rate, material sort, and grease, must be dealt with together to explore communication impacts among these factors. There are a few techniques produced for quantitative development of erosion at the pass on/work piece interface in metal shaping procedure. The most acknowledged one is to characterize a coefficient of contact, μ, the coulomb law of grating communicated as

$\tau = \mu . p$, where, τ is the frictional shear pressure and p is the typical pressure. Among every single normal strategy for estimating the grinding coefficient, the ring pressure test has increased wide acknowledgment. It was started by Kunogi and later improved and introduced in a usable manner by Male and Cockcroft . This method uses the dimensional changes of a test example to show up at the size of grating coefficient. At the point when a level ring example is plastically packed between two level platens, expanding contact brings about an internal progression of the material, while diminishing grinding brings about an outward progression of the material as schematically appeared in Fig.1. For a given level of stature decrease during pressure tests, the comparing estimation of the inner breadth of the test example gives a quantitative information on the greatness of the predominant grating coefficient at the pass on/work piece interface. On the off chance that the specimen‟s interior distance across increments during the disfigurement, grating is low; if the example's inside measurement diminishes during the misshapening, the rubbing is high.

Utilizing this relationship, explicit bends, later called grating alignment bends, were produced by Male and Cockcroft relating the rate decrease in the inner distance across of the test example to its decrease in stature for changing degrees of the coefficient of rubbing as appeared in Graph 1.

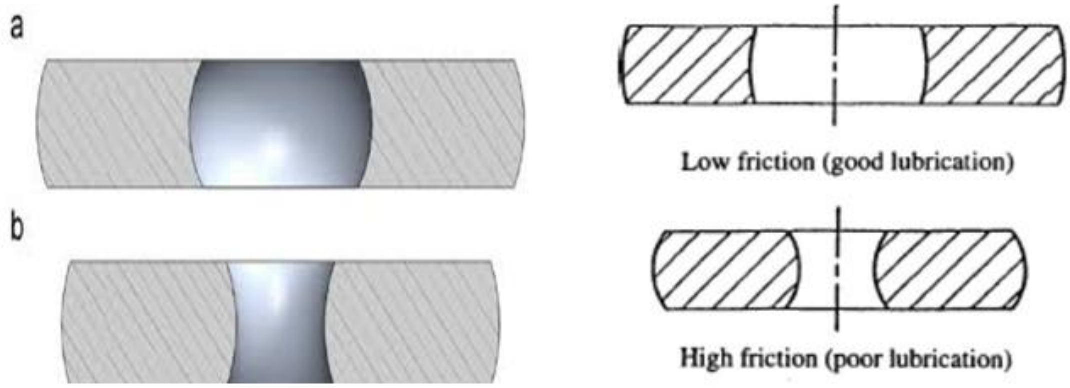
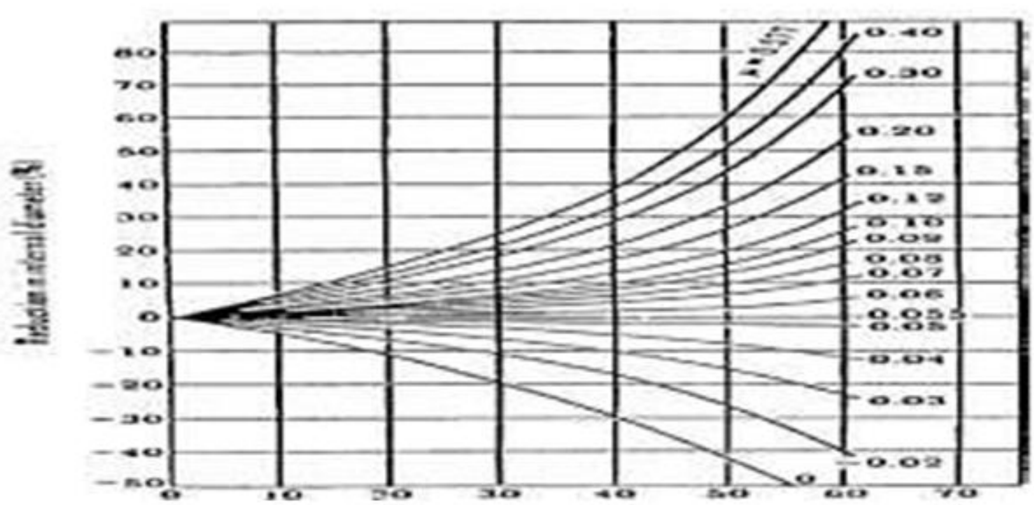


Fig. 1 Effect of friction magnitude on metal flow during the ring compression test

Male and Cockcroft"s standard ring geometry of 6:3:2 was utilized, and adjustment bends are framed to ring geometries. Each ring geometry; has its own particular arrangement of bends. The most widely recognized ring geometry is 6:3:2 where the primary number signifies the external measurement; and the subsequent number indicates the inner distance across while the last one is for stature of the ring. Lee built up a technique to discover the contact factor of the kick the bucket/work piece interface for the manufacturing procedure without the requirement for estimation of the shape changes of the work piece. Utilizing the proposed model to anticipate the impact of bite the dust speed on the grating variable demonstrated that the rubbing factor diminishes when the kick the bucket speed was expanded. Bugini created FEM adjustment outline for ring upsetting at room temperature when managing strengthened Aluminum examples of various stature. The technique permits the development of the grinding coefficient influencing the plastic stream when Teflon films are mediated among kicks the bucket and examples. Hayhurst proposed another strategy of alignment, which uses two test piece geometries, specifically the strong tube shaped pressure test piece and the ring pressure test piece. It has been demonstrated that it is conceivable to infer the genuine pressure genuine stain bend for the work piece materials; and, to align the contact model. The geometrical changes of all test pieces deliberately estimated all through the tests, for a scope of four distinctive grating conditions, dry contact, ointment, lead metal and nylon, have been anticipated with acceptable precision utilizing the genuine pressure genuine strain constitutive models; the two boundary rubbing model, and the limited component investigation systems. Sofuoglu and Rasty address the reliance of the rubbing alignment bends acquired for the coefficient of contact, μ, on such factors as material properties, strain-rate affectability, and dashing.



Graph. 1 Friction calibration curves in terms of μ Male and Cockcroft

Black and white plasticine as soft (nonmetallic) modeling materials and aluminum, copper, bronze and brass as metallic materials were used to conduct a number of ring compression tests. The necessary material parameters of plasticine for the finite element analysis were obtained from a series of the compression tests. It is observed that very few attempts have been made to generate friction calibration curve using other geometrical shape specimens. Detailed study on how the friction calibration on specimens behave during deformation and what type of deformation take place on the FE deformed mesh has not been conducted.

II. EXPERIMENTAL PROCEDURE

In ring compression test, the geometry of ring specimen has proportion of outer diameter to inner diameter to height (OD : ID: Thickness) of 6 : 3 : 2.In this study of friction calibration curve by ring compression test using three specimens developed: The name of first specimen is circle in circle i.e. ring, the geometry of ring specimen has proportion of OD : ID : Thickness. Dimensions of the specimen are 40 : 20 : 13.33. All dimensions in mm as shown in Fig.2

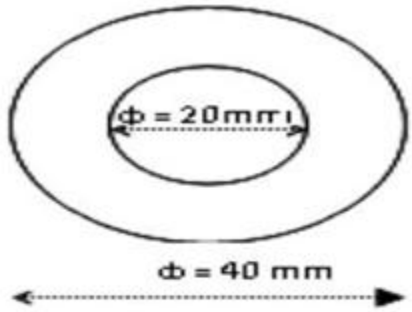


Fig. 2.1 Ring Geometry

Compression test on the specimens are carried out using UTM, All the specimens are comp- ressed between 30% to 45%. Percentage of compression and load applied on the specimens are shown in Table.2.1

Table.2.1 % of Compression and Load requirement on the specimen

S.No	Specimens	Load Applied (KN)	% of Compression
1.	Circle in Circle (Ring)	205	36.72

Specimen 1: Circle in Circle (Ring)

Fig. 2.3 (a) Specimen before and after compression

III. RESULTS

Values of coefficient of friction, nodal travel for different specimens and stress developed are given in Table.4.1 Using the experimental results and calibration curves, friction is determined for different type of specimens. There are given in Table.4 and compared to ring test results.

3.1 RESULTS

Nodal travel for different specimens and load requirement are given in Table 3.1

Table 3.1 The Coefficient of friction (coulomb) values by FE Simulation.

S.No	Specimens	Load Applied (KN)	% of Compression	Coefficient of Friction (µ)
1.	Circle in Circle (Ring)	205	36.72	0.07

3.1.1 CALCULATION FOR COEFFICIENT OF FRICTION (M) FOR RING.
For Circle (Ring):
Inner diameter of ring before compression = 20 mm
Inner diameter of ring after compression = 18.55 mm (18.55 mm This value calculated with help of verniers calipers)

% Change in inner diameter = [(20-18.55) / 20]*100 = 7.25 %
% Change in height = [(14-8.56) / 14]*100 = 38.85%
(8.56 mm this value calculated with help of verniers calipers)

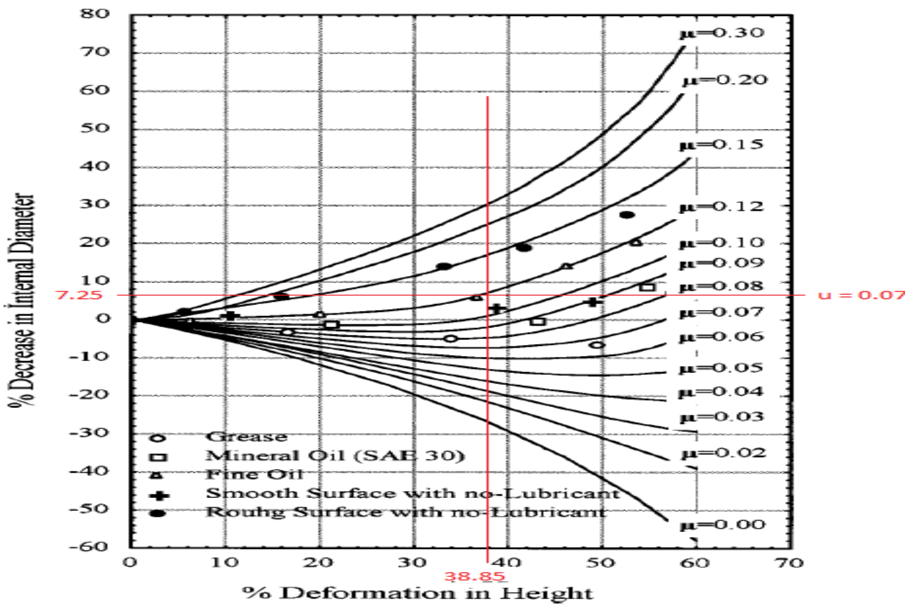


Fig 3.1 Friction calibration curves obtained from the ring compression test for copper in term of µ.

Value of Coefficient of Friction (µ) is 0.076 for Ring are measured by the above figure

3.2 ANALYTICAL CALCULATION:
For Coefficient of Friction (µ) for Ring.
For Circle (Ring):
Outer diameter (d_o) = 40 mm

Inner diameter (di) = 20 mm
Thickness (t) = 14mm

Area of outer circle: $\Pi/4 *do^2 = 1256\ mm^2$

Area of inner circle: $\Pi/4 *d_1^2 = 314.28\ mm^2$

$A = A_O - Ai = 1256 - 314.28 = 941.72mm^2$

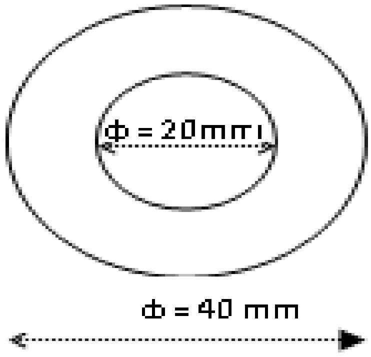


Fig 4.2 Ring specimen 2D and Actual model

Ϭ = F/A
Stress = F/A = 205000/941.72 = 217.68 MPa

Now **Shear stress** = Tangential force / Area
= 205000/ Π d t = 205000/ 3.14*20*14 =205000/879.2 = 233.17MPa

Shear Stress = 233.1 MPa
Using the experimental results and calibration curve friction is determined for different type of specimens. These are given in Table 4.2 and compared to ring test results.

Table 3.2 Comparison of Results

S.No	Specimens	Standard Coefficient of Friction (μ) (By Ring)	Calculate Coefficient of Friction (μ)	% Error
1.	Circle in Circle (Ring)	0.08	0.07	12.5%

IV. CONCLUSION

In this research work, we have been made to find alternative specimens for friction calibration using finite element simulation. One specimen is ring and experimental work. A ring of standard dimension is also tested in the same machine. It is observed that the geometry of specimens which consist any geometry shape inside circle gave very close friction value. Hence, friction prediction become quite simple uses such specimens, especially in the absence of ring specimens.

REFERENCE

[1]. G.E.Dieter, "Mechanical Metallurgy", Mcgraw-Hil1, Inc.,bostan,Ma,1986, P 539-549.
[2]. G.E.Dieter, "Workability Tests, Metals Handbook" volume 14. Forming And Forging, ASM International, Materials Park,OH,1988, P 379-381.
[3]. Wang.W, Wagoner.R.H., and Wang X.J., "Measurement Of Friction Under Sheet Forming Conditions", 27A, December, 1996, P 397.
[4]. Sofuoglu Hasan, Assistant Professor, Jahan Rasty, Associate Professor, On The "Determination Of Friction Coefficient Utilizing The Ring Compression Test", Journal Of Engineering Materials And Technology, 2001, P 338-348.
[5]. Sofuoglu H., Gedikli H., "Determination of Friction Coefficient Encountered In Large Deformation Processes", Triblolgy International, Vol. 35, 2002, P 27-34.
[6]. Shivprasad P.V. And Daves C.H.J., "An Assessment Of The Interface Friction Factor Using The Geometry Of Upset Specimen", Modelling And Simulation In Material Science And Engg., Vol. 13, 2005, P 355-360.
[7]. Sahin Mumin, Cem S.C., Etinarslan, Akata H. Erol, "Effect Of Surface Roughness On Friction Coefficients During Upsetting Processes For Different Materials", Materials And Design, Vol. 28(2), 2007, P 633-640.
[8]. Rudkins N.T., Hartley P., Pillinger L.A., Petty D.B., "Friction Modelling And Experimental Observation In Hot Ring Compression Tests", Journal Of Materials Processing Technology, Vol. 60, 1996, P 349-353.
[9]. Robinson T., H. Ou, C.G. Armstrong, "Study On Ring Compression Test Using Physical Modelling And FE Simulation", Journal Of

Materials Processing Technology Vol. 18, 2004, P 54-59.

[10]. Rao K.P. And Sivaram K., "A Review Of ring Compression Testing And Applicability Of The Calibration Curves", Jouranl Of Materials Processing Technology, Vol. 37, 2008, P 295-318.

[11]. Meyers M.A., Chawla K.K., "Mechnical Behaviour Of materials, The Fundamentals Of Elastic", Second Edition, (Prentice-Hall,1999).

[12]. Lee Chorng-Der, Cheng I Weng And Jee Gong Chang, "A Prediction Of The Friction Factor For The Forging Process", Metallurgical And Materials Transactions , Vol. 32, 2001, P 137-143.

Mayourshikha Pancholi. "Development of Circular Ring Specimens for Friction Determination in Metal Forming Process by Using Experimental Testing". *International Journal of Engineering Research and Applications (IJERA)*, vol.10 (06), 2020, pp 66-71.