# INVESTIGATIONS INTO THE PROCESS OF BALL BURNISHING

By

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## A B S T R A C T

Surface Plastic Deformation (SPD) on metals in cold condition results in favourable changes in the surface layers. Compressive residual stress is induced and improved fatigue strength, surface hardness, wear resistance and resistance to corrosion are obtained. Associated with these beneficial effects very fine surface finish can be achieved by ball burnishing. Therefore ball burnishing process offers considerable potential for being adopted as a finishing operation on metals.

The purpose of this investigation has been to find out suitability of hardened steel balls (in place of diamond balls) in burnishing rods and flats of structural steel, the degree to which the surface integrity is improved so as to substitute higher grade steel and to select the size of the ball and load on it for producing the best results.

The burnishing attachment, designed for this investigation, consists of a hydraulic cylinder with a piston, a detachable burnishing head fitted to the cylinder and a pressure gauge to measure the burnishing load. The attachment can be clamped on the toolpost of a lathe or on the tool holder of a shaper. Various loads have been applied on

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balls of different sizes while burnishing flat and cylindrical surfaces. The best surface finish of 0.1 um has been obtained with the ball of 12.67 mm dia under 36 kg on cylindrical specimens of mild steel. Residual stresses in steps of 0.002 mm removal of metal were measured by employing bending deflection method involving continuous removal of successive layers in electropolishing. Distribution of hardness across the thickness subsequent to burnishing has been measured on a microhardness tester.

The mechanics of ball burnishing process has been analysed to establish an approach for predicting the burnishing load. An idealised model, based on the action of a load on the surface of a semi-infinite solid of homogeneous and isotropic material under plane strain conditions, has been proposed for the determination of residual stress distribution.

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Prasanta Kumar
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CERTIFICATE

This is to certify that the thesis entitled "Investigations into the process of ball burnishing" being submitted by Mr. P.K. Bhattacharyya to the Indian Institute of Technology, Delhi for the award of degree of Doctor of Philosophy in Engineering is a record of bona fide research work carried out by him. He has worked under my guidance and supervision and has fulfilled the requirements for the submission of the thesis which, to my knowledge, has reached the requisite standard.

The results contained in this Thesis have not been submitted, in part or full, to any other University or Institute for the award of any degree or diploma.

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| Chapter | | Page No. |
|---|---|---|
| 1. | Introduction | 3 |
| 2. | Review of Literature | 9 |
| 2.1 | Different types of burnishing and their effects | 9 |
| 2.1.1 | Burnishing with diamond balls | 9 |
| 2.1.2 | Burnishing with steel balls and steel rollers | 11 |
| 2.1.3 | Internal burnishing | 13 |
| 2.1.4 | Burnishing on plated surfaces and plastics | 15 |
| 2.1.5 | Vibro-burnishing | 15 |
| 2.1.6 | Comparative study of roller, ball and centrifugal ball burnishing | 18 |
| 2.1.7 | Economic aspect of burnishing | 20 |
| 2.1.8 | Effects of burnishing | 21 |
| 2.2 | Surface roughness and its effect on service life of components | 28 |
| 2.2.1 | Roughness of machined surfaces | 28 |
| 2.2.2 | Effect of surface finish on service life of components | 36 |
| 2.2.3 | Effect of surface finish on initiation of crack | 51 |
| 2.3 | Residual stress and its effect on the service life of components | 52 |
| 2.3.1 | Residual stresses | 52 |

| | | |
|---|---|---|
| 2.3.2 | Effect of residual stresses on service life of components | 61 |
| 3. | Analysis of the mechanics of ball burnishing | 66 |
| 3.1 | Initial plastic deformation in local contact of surfaces | 66 |
| 3.2 | Sliding of metal sphere on a softer metal | 71 |
| 3.2.1 | Effect of depth of penetration (h) | 71 |
| 3.2.2 | Correlation of contact area and burnishing load, contact pressure and burnishing load. | 75 |
| 3.2.3 | Depth of work hardened layer | 79 |
| 3.3 | Mechanics of ball burnishing and prediction of burnishing load | 81 |
| 3.4 | Condition for piling up of work-material ahead of the ball | 87 |
| 4. | Analytical approach to determine the residual stress distribution | 90 |
| 4.1 | General | 90 |
| 4.2 | The model | 91 |
| 4.3 | Strain field within semi-infinite solid under a concentrated load | 94 |
| 4.4 | Numerical method for the determination of residual-stress distribution | 97 |
| 4.5 | Computation of equivalent rolling load | 105 |
| 5. | Experimental set up and experimentation | 106 |

| | | |
|---|---|---|
| 5.1 | Ball burnishing attachment | 106 |
| 5.1.1 | General considerations | 106 |
| 5.1.2 | Design of ball burnishing attachment | 107 |
| 5.1.3 | Ball burnishing on flat surface | 117 |
| 5.2 | Experiment to determine residual stresses | 118 |
| 5.2.1 | Layer removal method | 118 |
| 5.2.2 | Set up for electropolishing | 120 |
| 5.2.3 | Measurement of the thickness of layer removed | 124 |
| 5.2.4 | Measurement of deflection | 126 |
| 5.2.5 | Computation of residual stresses from values of deflection, initial and final thickness. | 126 |
| 5.3 | Specimen preparation | 133 |
| 5.3.1 | Flat specimens | 133 |
| 5.3.2 | Cylindrical specimens | 138 |
| 5.3.3 | Car axle | 139 |
| 5.4 | Experimental details | 141 |
| 5.4.1 | Flat specimens | 141 |
| 5.4.2 | Cylindrical specimens | 144 |
| 5.5 | List of Machines and Instruments | 146 |
| 6. | Results and Discussion | 148 |
| 6.1 | Analytical results | 148 |
| 6.1.1 | Predicted values of burnishing load | 148 |

| | | |
|---|---|---|
| 6.1.2 | Predicted values of residual stresses | 153 |
| 6.2 | Experimental results | 156 |
| 6.2.1 | Correlation of roughness and burnishing parameters | 156 |
| 6.2.2 | Experimental values of residual stresses and microhardness | 173 |
| 6.3 | Discussions on experimental results | 185 |
| 6.3.1 | Correlation of Surface roughness and burnishing load | 185 |
| 6.3.2 | Residual stress and microhardness | 187 |
| 6.4 | Comparison of analytical and experimental results | 189 |
| 6.4.1 | Residual stresses | 189 |
| 6.4.2 | Surface roughness | 195 |
| 7. | Conclusions and suggestions for further work | 197 |
| 7.1 | Conclusion | 197 |
| 7.2 | Suggestion for further work | 201 |
| | References | 203 |
| | Appendices | 216 |