

A Review: Establishment the co-relation of important mechanical properties measured by experimental and image processing

Vivek Bhensdadia^a, Dr. Jignasa Mehta^b, Dr.Dipesh Kundaliya^c

^aM.E. CAD/CAM Sem-III, Gujarat Technological University, Rajkot

^bH.O.D. Department of Mechanical Engineering, V.V.P. engineering College Rajkot

^c Faculty of Mechanical Department in V.V.P. engineering College, Rajkot

ABSTRACT

In industry steel is vital requirement depending upon carbon percentage and widely used in industries like automobile and shipping industries. It is observed that Heat treatment process is having considerable effect on microstructure and mechanical properties of steel. Earlier research work on microstructure and mechanical properties was carried out on the basis of experimental method like hardness measurement with the help of hardness tester. Present investigate deals with non-contact type image processing to measured brinell hardness. The obtained relationship establishes by experimentally and image analysis. Image analysis using MATLAB software is employed to measure the diameter of the indentation from the obtained images. By non-contact type of image processing measurement, a result is obtained irrespective of variation in time, faster and more cost-effective solution.

Keywords: Image processing, hardness, MATLAB.

INTRODUCTION

Nowadays, Machine vision is used everywhere such as manufacturing field, inspection and so on. Finding mechanical property by using computer vision is newly developed concept. Hardness is the property of a material that enables it to resist plastic deformations, usually by penetration. It may also refer to resistance to bending, scratching, abrasion or cutting. Hardness is an intensive property it is not dependent on the amount of matter. Three main types of hardness measurement i) scratch hardness ii) indentation hardness iii) rebound hardness. The usual method to achieve a hardness value is to measure the depth or area of an indentation left by an indenter of a specific shape, with a specific force applied for a specific time. There are three principal standard test methods for expressing the relationship between hardness and the size of the impression:

- Brinell hardness,
- Vickers hardness
- Rockwell hardness

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. Image processing involves changing the nature of an image in

order to either i) Improve its pictorial information for human interpretation ii) Render it more suitable for autonomous machine perception. [4]

Machine vision is applicable for mechanical parts defect detection [3], Heat transfer [1], Medical Area [2], Industry [4], Agriculture [4], Law enforcement [4], Pattern recognition, Video processing.

LITERATURE STUDY

In this research, Machine vision is used for find optimal conditions of cutting which potentially characterizes status of tool wear, acoustic emission. In processing Nimonic75 using coated carbide insert is used for finding an optimal condition by using machine vision. [5]

The optimal condition of Nimonic75 has been observed as per Taguchi's standard orthogonal array (L27). Non-traditional measuring techniques like machine vision and AE sensors could be used for measuring response parameters to optimize the cutting process. [5]

This research presents the effect of different aluminium temperature and cooling method of heat treatment process on mechanical properties of aluminized steel and result show the mechanical performance change condition of the raw material is mainly affected by the heat treatment processing after the common steel Q345 is heat treated. [6]

Three different processing method are applied water cooling, air cooling and immediate water cooling after aluminizing and 1 min after air cooling and get result of Aluminizing heat treatment process that heat treatment process is carry out 780 °C, the water cooling isn't suitable to production of the aluminized steel, air cooling will reduce yield strength of the material by 30-40Mpa, it has less influence on elongation rate of the raw materials. If aluminizing temperature drops down to 715-735 °C, mechanical performance of the raw material is kept when air cooling is applied. [6]

Table 1 The mechanical properties of Q345 steel under different cooling conditions [6]

No.	T/°C	t/min	Cooling	UTS/MPa	REL/MPa	EL/%
A1	780	0	-	616	383	25.0
A2	780	0	-	609	384	27.0
B1	780	5	Water cooling	921	452	10.0
B2	780	3	Water cooling	889	459	10.0
B3	780	2	Water cooling	877	520	18.0
B4	780	1	Water cooling	876	580	11.5
C1	780	3.5	Air cooling	572	349	26.5
C2	780	5	Air cooling 1 min after	571	376	28.5
D1	780	5	Water cooling	846	491	14.0

This research is a comparison of the results obtained by use of traditional methodology to measure the Brinell hardness value with different optical equipment has been performed. For Brinell hardness indentation diameter should be measured. This paper proposes an alternative measurement methodology using confocal microscopy it is allows to determine a unique indentation edge. [7]

Traditional Brinell hardness measurement methodology is simple and fast, but not enough to guarantee because, the lack of information about the edge line where measurements should be taken. New model theory to determine the Brinell hardness based on the indentation measurement and confocal microscopy defines a unique indentation diameter on the edge. [7]

This research investigated relationship between Brinell hardness and tensile strength of wood plastic composites and relation between brinell hardness and tensile strength of the sawdust flour was compounded with polypropylene at 30%, 40% or 50% (by weight) content with and without coupling agent, maleic grafted polypropylene with anhydride, in a twin screw co-rotating extruder. [8]

Table 2 Tensile strength and Brinell hardness of the wood plastic composites(WPC) [8]

WPC	Density	Mechanical properties	
		Tensile strength(MPa)	Brinell hardness(HB)
A	0.98(0.02)	24.04	102.27
B	0.99(0.01)	27.28	113.20
C	1.02(0.02)	22.25	137.07
D	1.00(0.02)	26.92	109.67
E	1.01(0.04)	32.51	127.40
F	1.04(0.01)	25.76	148.93

The Brinell hardness of the wood plastic composites (WPC) improved with increasing content of the sawdust flour and other side tensile strength decreased when the content of sawdust flour was beyond 40 wt%. [8]

This paper deal with a machine-vision system was developed for determining the size and location of individual longans in the bunches of longan fruits. This paper is used for determining the size and location of specimen by image processing technique. MATLAB programming is use for determining the size and location of specimen. [9]

Error of the size determination using the developed image processing technique, as compared to actual sizes of longan fruits is less than 10%. When longans fruits not overlapped then image technique could locate 90% of individual longans and detect 79% of the overlapped longan fruit in the images. [9]

CONCLUSION

After brief literature survey it is concluded that Brinell tests use a carbide ball indenter and Brinell hardness number (BHN) is a function of the test force divided by the curved surface area of the indent. Image

analysis using MATLAB software is employed to measure the diameter of the indentation from the obtained images.

It is also concluded that digitizing the process of hardness measurement a stable result is obtained irrespective of variation in time and accurately measure indenter diameter.

For finding mechanical property with the help of machine vision is newly developed concept.

REFERENCES

- [1] Xuejing Zheng, Rui Shi, Shijun You, Yong Han : "Experimental Study Of Defrosting Control Method Based On Image Processing Technology For Air Source Heat Pumps"
- [2] Chaoli,souleymaneballa-arabe,fanyang:"embedded Multi Spectral Image Processing Forreal-time Medical Application"
- [3] Hu Yu: "Mechanical Parts Defect Detection Method Based On Computer Vision Technology" IEEE 2015
- [4] Introduction To Digital Image Processing With Matlab By Alasdair Mcandrew
- [5] Y.D. Chethan, H.V. Ravindra, Y.T. Krishnegowda:-optimization Of Machining Parameters In Turning Nimonic-75 Using Machine Vision And Acoustic Emission Signals By Taguchi Technique, ELSEVIER 2019 (pp 144–154)
- [6] Xue Shangqing, Wang Xuming, Lin Bo, Chen Dequan, Li Rongmin:-effect Of Heat Treatment Process On Mechanical Properties Of Aluminized Steel, IEEE 2016
- [7] C. Barajas, J. de Vicente, J. Caja, P. Maresca, E. Gomez:-Consideration to the hardness brinell measurement using optical equipment, ELSEVIER 2017 (pp 550–557)
- [8] Alperen Kaymakci, Nadir Ayrilmis:- Investigation of correlation between Brinell hardness and tensile strength of wood plastic composites, ELSEVIER 2014 (pp 582–585)
- [9] Chawaroj Jaisin, Siwalak Pathaveerat, Anupun Terdwongworakul:- Determining the size and location of longans in bunches by image processing technique. Maejo International Journal of Science and Technology 2013