iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** II **Month of publication:** February 2018

DOI: http://doi.org/10.22214/ijraset.2018.2050

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue II, February 2018- Available at www.ijraset.com

Study of Mechanical Property of Sintered Iron Preform

Nitish Kumar Singh[1], Mahendra Kumar Malviya[2],
[1.2.] *Department of Mechanical Engineering, National Institute of Technical Teachers' Training and Research, Bhopal*

Abstract: This Paper about study and determination of mechanical properties of pure metal preform of iron made by the process powder metallurgy, owing to recent trend of using powder metallurgy products basically in structural automotive components based in ferrous alloys.

I. INTRODUCTION

Powder metallurgy is the process of blending fine powdered materials , pressing them into a desired shape or form (Compacting) and then heating the compressed material in a controlled atmosphere to bond the material (Sintering).the powder matallurgy process consists of four basic steps powder manufacture, powder blending, compacting, and sintering. Compacting is generally performed at room temperature, and the elevated-temperature process of sintering is usually conducted at atmospheric pressure. The use of powder metal technology bypasses the need to manufacture the resulting products by metal removal processes, thereby reducing costs. Powder metallurgy (PM) is a term covering a wide range of ways in which materials or components are made from metal powders. PM processes can avoid, or greatly reduce, the need to use metal removal processes, thereby drastically reducing yield losses in manufacture and often resulting in lower costs.

II. MATERIAL AND EXPERIMENTAL PROCEDURES:

A. Cad model design

First of all ,3-D CAD design of die was prepared with the following specifications. inner diameter 15mm ,outer diameter 45 mm ,height 50mm. The metal preform to be prepared was chosen to have L/D ratio between 1-2 i.e. in the short range to avoid buckling . So, accordingly the inner diameter was chosen to be 15mm which was also dependant on the ease of manufacturing taking into consideration that 15mm drill-bit was readily available and no further boring operation was required. The length of the die was calculated based on:

1) The fact that upon compaction, the powder will compact to around half the height it is filled with in the die, and

2) Taking into consideration that final L/D ratio of the compacted iron needs to be between 1 to 2.

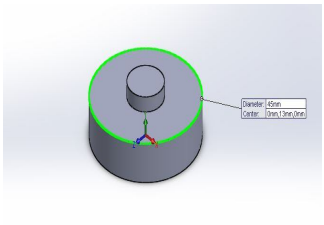


Fig 2.1 base of die

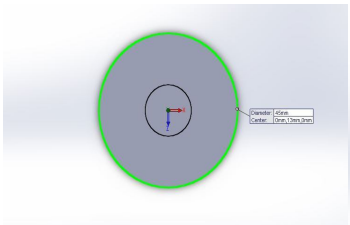


Fig 2.2top view of base

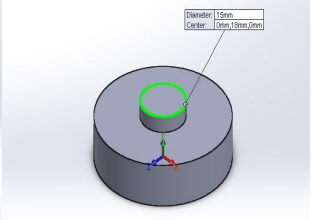


Fig 2.3 upper part of die.

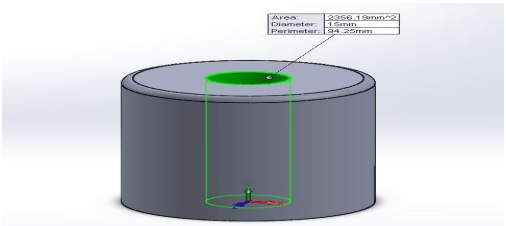


Fig 2.4 body of Die

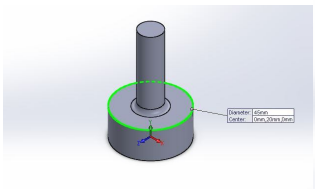


Fig 2.5 plunger

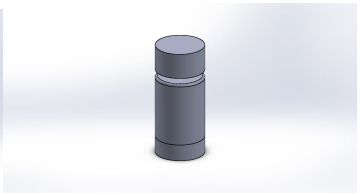
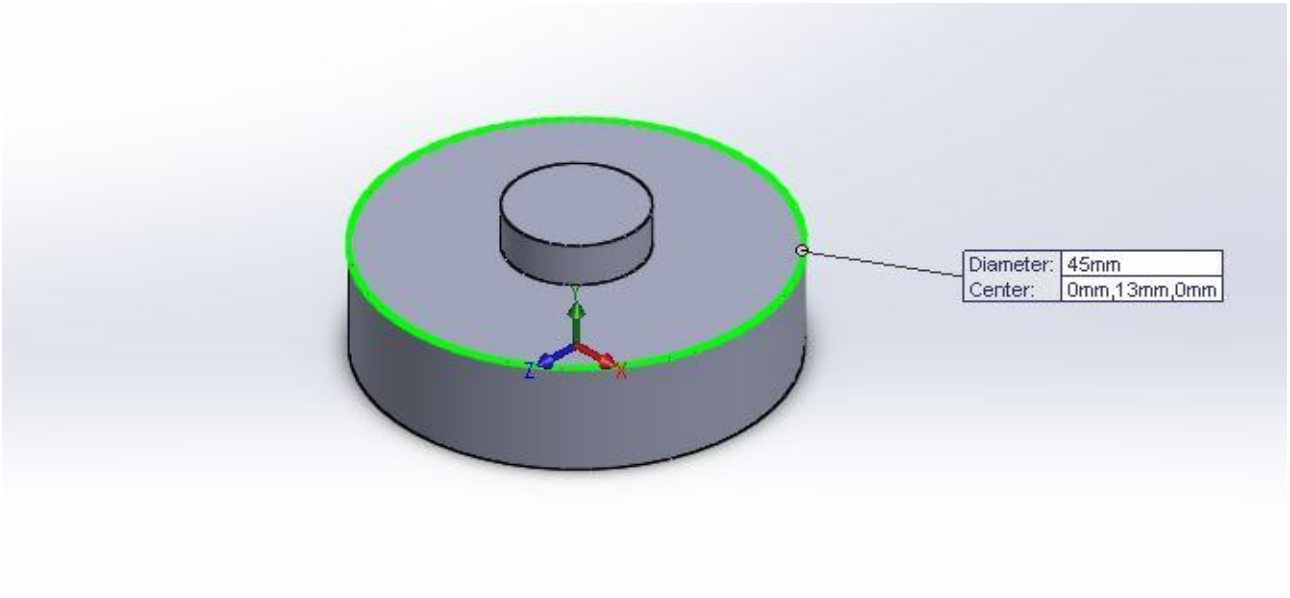


Fig 2.6 Final assembly



B. Preparation of Die.

Material Used: Mild Steel.

Machining operation involved:

1) Shaping of mild steel block in shaper.
2) Turning on centre lathe.
3) Facing and filleting operation on centre lathe.
4) Drilling operation in drilling machine.

Case Hardening (Carburizing method) of inner surface of the die and outer surface of the plunger to improve wear resistance

Fig 2.7 final product

III. RESULT AND DISCUSSION

A. *Compacting of Iron Powder*

1) Compacting of iron powder in the die was carried out under application of load in Universal Testing Machine (UTM) in testing laboratory of Mechanical Engineering Department.
2) Initially, the inner surface of the die was coated slightly with slurry of graphite powder to ease out the removal of the compacted iron metal preform.
3) Mass of iron powder used per metal preform: 20 grams.

B. *Load Applied*

1) 5 KN - It was found that the compacted iron metal preform made under this load did not maintain enough strength and turned to powder upon removal from the die.
2) 6 KN – The strength was still not satisfactory.
3) 7 KN – At this load, satisfactory strength was found upon release from die.

Compacted iron metal perform

C. *Sintering of compacted iron metal preform*

Sintering operation was done in Physics Laboratory in programmable arc furnace at a temperature of 1120^{o} C, for five hours followed by standard cooling. Sizing of preform:

The L/D ratio was taken as 5/3 (1.66).

D. *Mechanical Testing*

Two types of mechanical testing were done.

1) *Brinell Hardness Test*

Brinell Hardness Test was performed with the sintered specimen in Mechanical Engineering Laboratory.

a) Applied force: 2 KN
b) D (diameter of indenter): 5mm
c) d (diameter of indentation): 3.6 mm
d) HB obtained – 83.211 BHW
e) Which was found to be less than the Brinell Hardness Number of Normally Mild Steel – 130 BHW

2) *Charpy Impact Test:*

a) The test was done at normal room temperature.
b) Specification of the notched specimen:
c) Energy consumed in fracture: 25 Joules
d) This is again less when compared to the dynamic energy of mild steel obtained from same Charpy Impact test at room temperature which is around 50-60 Joules.

IV. CONCLUSION

This project started as an initial step at studying the scope of Powder Metallurgy products in various sections of the industry. We determined the mechanical properties of pure sintered iron preforms. Certainly, improvements in mechanical properties can be done by alloying powdered iron before compacting

REFERENCES

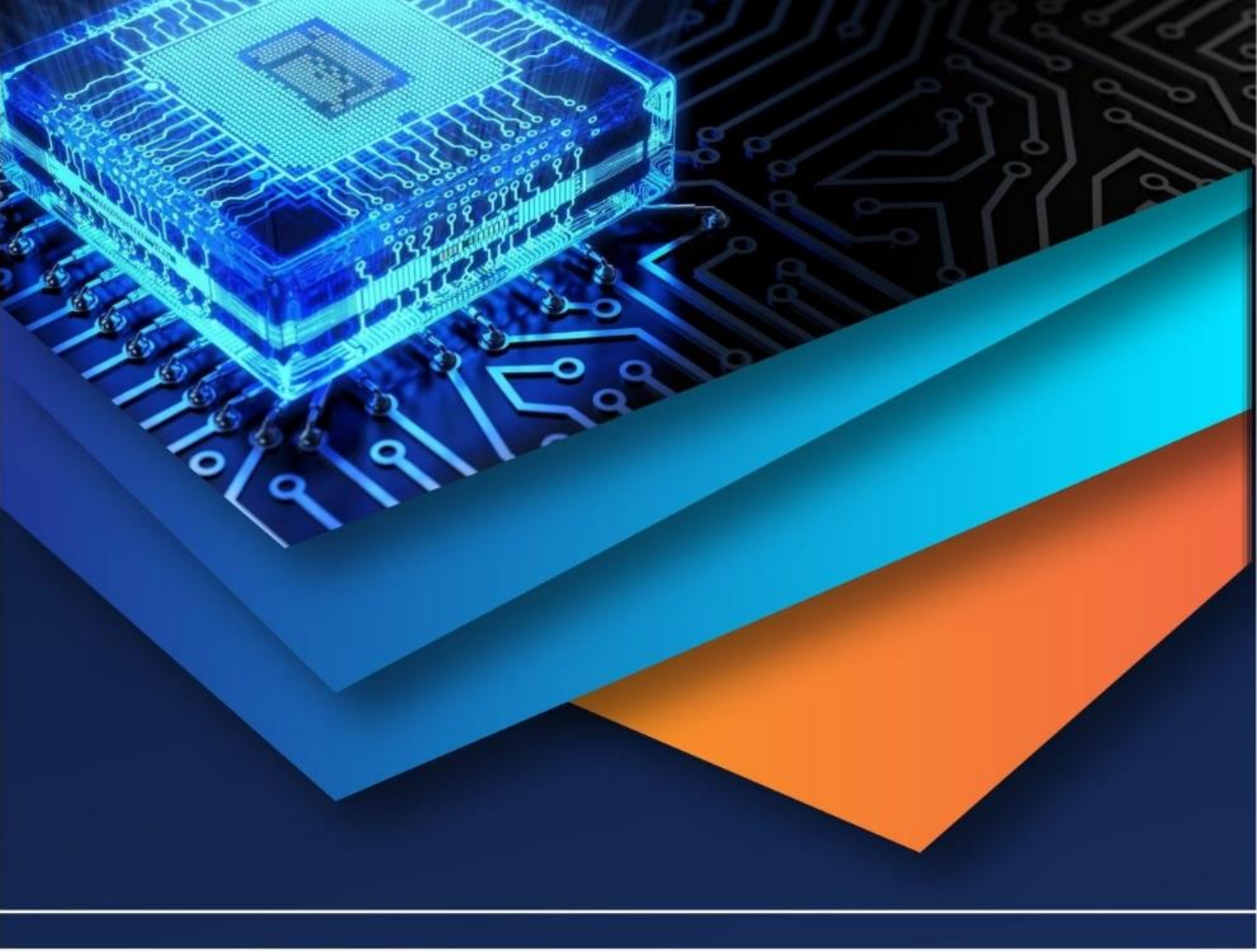
[1] KS. Narasimhan, Sintering of powder mixtures and the Growth of ferrous powder metallurgy, Materials Chemical Physic 67 (2001) 56-65.

[2] D. L. Crews, "Quality and Specifications of Ductile Iron." Transactions, American Foundrymen's Society, Vol. 82, 1974, pp. 223-228.)

[3] POLITECHNIKA KRAKOWSKA Institute of Materials Science and Metal Technology, FINAL THESIS by Juan Manuel Cantón Soria July 2008 (Kraków).

[4] Properties of High Density Sinter-Hardening P/M Steel processed Using an Advanced Binder Syste Michael L. Marucci, Michael C. Baran, and K.S. Nar Hoeganaes Corporatio Cinnaminson, NJ 08077 Presented at PM2TEC200

[5] World Congress on Powder Metallurgy & Particulate Material June 16-21, 2002, Orlando, Florida



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY