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COMPARING THE SIC-IRON, AL2O3-IRON POWDER COMBINATION USING MICROWAVE SINTERING IN TERMS OF SURFACE FINISH

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Abstract-Magnetically Assisted Abrasive Finishing (MAAF) forms are most reasonable for acquiring quality finish on metallic and non-metallic surfaces. The fabricating systems for getting ready attractive abrasives are tedious and complicated. Microwave warming is a standout amongst the most usually utilized apparatuses for warming purposes in kitchen applications. Be that as it may, as of late, microwave has begun utilizing as a non regular warming source in current mechanical level applications. The most widely recognized warming application in non-traditional warming is microwave sintering of ceramic materials, since it is fast and sintering is done inside a moment timeframe around 4 % of the customary sintering time. The principle point of the present work is to plan attractive abrasives by this microwave sintering innovation, which is additionally utilized as a part of attractive completing procedures. The attractive abrasives are additionally thought about as far as surface wrap up. Attractive abrasives are set up by blending iron powder (ferromagnetic part) and Al2O3/SiC (grating segment), sintered by microwave sintering and after that squashed. Metal and SS-304 material funnels have been utilized as work piece. In view of the aftereffects of the investigation, SiC-press indicated preferable execution over Al2O3-press powder blend.
Keywords: Material Removal Rate; Microwave Sintering; Surface Roughness; Super Finishing

1. INTRODUCTION

The utilization of microwaves in clay handling is a moderately late advancement. They can be connected adequately and proficiently to warm and sinter clay objects. The latest improvement in microwave applications is in sintering of metal powders, a shocking application, in perspective of the way that mass metals reflect microwaves. Nonetheless, reflection by a metal happens just in the event that it is in a strong, nonporous shape and is presented to microwaves at room temperature. Metal as powder will retain microwaves at room temperature and will be warmed viably and quickly. This innovation can be utilized to sinter different powder metal parts, and has delivered valuable items extending from little chambers, bars, gears and car segments in 30-90 min. A portion of the potential advantages from consolidating microwave sintering innovations in the orthopedic embed industry incorporate time and vitality investment funds, other than giving enhanced microstructures and prevalent mechanical properties.

1.1 Working Principle

A microwave oven utilizes microwaves to warm sustenance. Microwaves are radio waves. On account of microwave oven, the regularly utilized radio wave recurrence is approximately 2,500 megahertz (2.5 gigahertz). Particles of all sustenance are comprise of a dipole and have positive charge in one side and have negative charge in another side. On the off chance that we put electromagnetic fields in this, all particles are revamped: positive charge is to negative post and negative charge is to positive shaft. In this procedure particles warm is created by grating. The recurrence of microwave oven is 2,500 megahertz as we saw some time recently. At that point microwave of this recurrence alter the course of electromagnetic fields 2,500,000,000 times in 1 second. Subsequently the warmth productivity of a microwave stove is significantly high. In microwave cooking, the radio waves infiltrate the nourishment and energize water and fat particles practically equally all through the sustenance. The most prominent characteristic of microwave warming is volumetric heating, which is not the same as regular warming where the warmth must diffuse in from the surface of the material. Volumetric warming implies that materials can retain microwave vitality specifically and inside and change over it to warm. It is this trademark prompts favorable circumstances utilizing microwaves to process materials.

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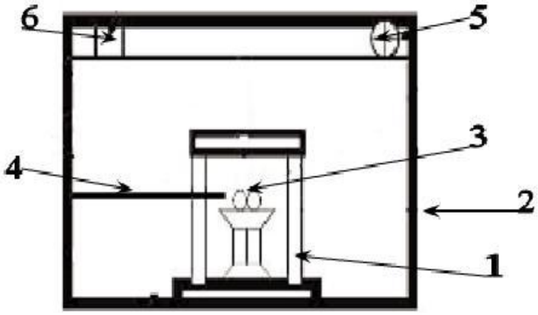


Figure 1.1. Schematic of Microwave Sintering Furnace 1.Thermal containment box 2.Stainless steel microwave cavity3.Ceramic samples4.Thermocouple 5.Power input control and adjustment knob 6.Digital temperature indicator

2. LITERATURE REVIEW

Hwang et al (2004) directed their examinations on examinations concerning the sintering of the Magnesium Fluoride optical materials by microwaves. The sintering was led in a 2.45 GHz microwave instrument under an argon climate. As got MgF_2 powder was calcinated in argon at 600 deg Celsius for 2 hours and ground with a mortar to pass a 325 work screen. The ground powder was blended with 2% gum as fastener. Microwave sintering was performed with a 4 kW microwave heater. MgF_2 circles were put at the focal point of the hot load encompassed by quartz susceptors. Zirconia globules were put on the base of the chamber, keeping in mind the end goal to maintain a strategic distance from conceivable responses of the obstinate protection with example and in addition the quartz susceptors. A K-type thermocouple was utilized to quantify the chamber temperature.

[1] done the examination between ordinary sintering and microwave sintering for $SrTiO_3$ and found that microwaves improves the rate of dissemination of the particles in the materials with the end goal that powders can be sintered at a temperature around 200ºC lower than that expected to accomplish a similar thickness in a regular sintering heater.

[2] utilized microwave sintering innovation for making metal parts. They regarded different metal powders, for example, iron, copper, aluminum, nickel, cobalt, tungsten, tin and tungsten carbide metal powders for making combinations of at least two than two parent metals.

[3] researched the adequacy and legitimacy of an attractive grating completing (MAF) to refine rough surfaces and sharp edges of silver steel bars. The magneto-abrasive particles were created by mixing alumina and iron powders, compacting in a heater at temperature 1400ºC and inert medium for 1 hour time period, squashing into littler particles and sieving to various scope of sizes.

[4] completed a correlation amongst microwave and traditional sintering of WC/Co composites & researched that WC/Co tests sintered in a microwave field differ drastically as far as phases, chemistry and microstructure when contrasted with routinely sintered examples.

[5] done different analyses upon low temperature sintering of barium titanate utilizing a microwave sintering process. A fluid stage sintering was done within the sight of barium borate as a fluid stage. Barium borate shapes a fluid stage at 924ºC when blended with barium titanate and does not frame some other substance segment in microwave sintering heater.

[6] In this paper, an examination has been made between the execution and qualities of attractive abrasives arranged by a recently created system (Mechanical alloying) and a typical method (Sintering). Mechanical alloying and sintering process have been utilized to plan attractive abrasives having 15% SiC and 85% Fe as constituent powders. A trial set up was created for the direct of test work.

3. PROBLEM FORMULATION

The present work for the most part manages the advancement of attractive abrasives and execution of these attractive abrasives. The abrasive segments (Al_2O_3, SiC) must be strongly bonded to ferromagnetic particles to form a magnetic abrasive. This examination primarily expects to create attractive abrasives by microwave sintering innovation and after that looking at their execution on two diverse material work pieces.

3.1 Objective of study

1. Development of new attractive abrasives by utilizing microwave sintering innovation.
2. Comparison of created magnetic abrasives between MA-Al_2O_3 and MA-SiC as far as rate change in surface roughness.

4. EXPERIMENTATION

4.1 Preparation Of Magnetic Abrasive

For exhibit work, the attractive abrasives have been set up by microwave sintering method. For this reason, a lab microwave sintering heater, parent metal powders and a crucible for setting the parent metal powders in the microwave sintering heater are required. The microwave heater should reach up to 1400ºC temperature

4.2 Susceptor required for microwave sintering

Microwaves are consumed by the powdered metal and after that it is the guideline instrument of warming in microwave heater that at first microwaves go into the mass and at the inward center of the mass, changed over into warm vitality. At that point this warmth streams outside towards the surface of the mass set in the microwaves. In any case, a few microwaves are reflected in reverse by the metal powders. So for this reason, an extraordinary sort of susceptor (crucible) is utilized as a part of which metal powder blend is put and after that it is set in the microwave heater.

4.3 Sintering of Powder Mixture in Microwave Sintering Furnace

STEP 1. Microwave Sintering of abrasive and iron powder mixture
STEP 2. Crushing of solid mass
STEP 3. Sorting of magnetic abrasives

Table 4.1. Composition of Magnetic Abrasive and Microwave Sintering Conditions
(Temperature maintained in furnace – 1250ºC and Time taken – 2 minutes for each)

Sample Number	Ferromagnetic component Percentage (Iron powder)	Abrasive component Percentage (SiC and Al2O3)
1.	60	40
2.	70	30
3.	80	20
4.	85	15
5.	90	10

Table 4.2: Scheme of Experimentation

Proportion offerromagnetic/ abrasivecomponent	Material ofWorkpiece	Condition ofmagneticabrasive	Abrasive	Material	Outputparameters
60:40	Brass	Wet	Al2O3		Surface
70:30	Stainless	Dry	SiC		Finish
80:20	steel				
85:15					
90:10					

5. RESULTS AND DISCUSSION

Table5.1: Percentage improvement in S.F. using Iron + SiC sintered Magnetic Abrasives(For Brass Workpiece)

Sample No.	Dry Condition	Wet Condition
1.	27.60	36.58
2.	33.49	40.32
3.	37.24	46.21
4.	44.92	52.48
5.	38.36	47.84

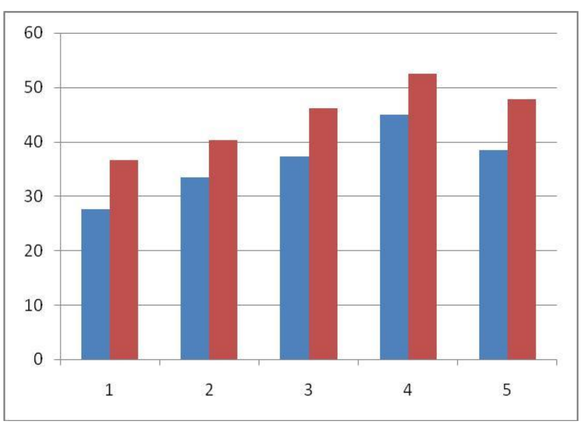


Table5.2: Percentage improvement in S.F. using Iron + SiC sintered Magnetic Abrasives (For Stainless steel)

Sample No.	Dry Condition	Wet Condition
1.	20.56	27.85
2.	23.68	32.58
3.	27.67	35.56
4.	32.83	40.28
5.	30.52	37.84

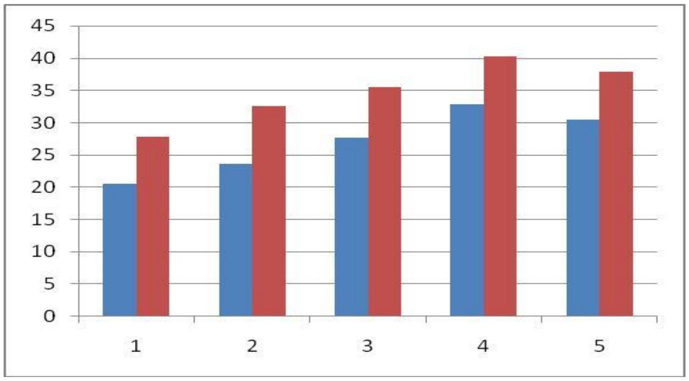


Table5.3: Percentage improvement in S.F. using Iron + Al2O3 sintered Magnetic Abrasives (For Brass Workpiece)

Sample No.	Dry Condition	Wet Condition
1.	24.49	28.58
2.	31.63	33.67
3.	35.56	41.84
4.	40.84	47.24
5.	36.92	42.26

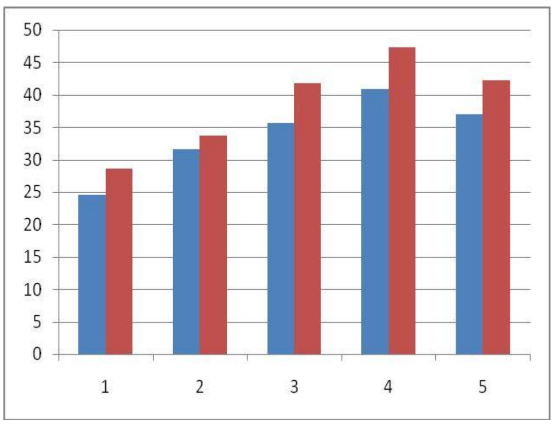
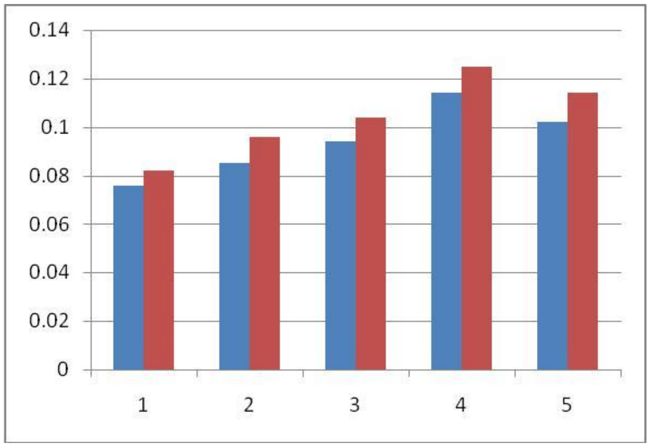


Table5.4: Percentage improvement in S.F. using Iron + Al2O3 sintered Magnetic Abrasives (For Stainless steel)

Sample No.	Dry Condition	Wet Condition
1.	13.58	20.6
2.	18.64	23.58
3.	23.68	27.83
4.	28.25	32.86
5.	24.84	30.52



6. CONCLUSIONS

1. The recently created attractive abrasives (blend of iron powder and grating powder) can fine machining of work-piece like metal and stainless steel.
2. The most extreme rate improvement in surface complete upon metal material has been acquired approx. 53 % and for stainless steel approx. 41 % utilizing SiC and press segments in attractive rough blend.
3. The best change in surface complete was acquired by utilizing creation of 85% iron and 15% grating by weight utilizing the two kinds of abrasives.

7. ACKNOWLEDGEMENT

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