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MORPHOLOGY OF MAGNETIC ABRASSIVE PARTICLE (MAP'S) BASED USING SOLID PHASE SINTERING METHOD

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ABSTRACT

Magnetic abrasive particles (MAP's) have been developed using solid phase sintering method with Carbonyl iron powder and silicon carbide abrasives. After sintering, the furnace cooling was done in inert atmosphere of argon upto environment temperature. After sintering, the sintered pellets have been crushed in ball mill to obtain the required size of the magnetic abrasive particles. The morphology and elemental composition as well as particle size of magnetic abrasive particles have been studied with scanning electron microscope (SEM) and energy dispersive spectrometer (EDS).The different phases of magnetic abrasive particles have been studied using X-ray diffraction (XRD).

Keywords: *Magnetic Abrasive Particles (Maps), Sintering, Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD).*

I. INTRODUCTION

Many technical investigations by materials scientists have been continuously aimed towards improving the performance and characteristics of materials, major improvements in mechanical and physical properties have been achieved through chemistry variations, mechanical, and thermo mechanical processing methods. [1].SiC is a chemical compound of silicon and carbon. It shaped by an elevated temperature electrochemical effect of sand and carbon. SiC is a brilliant abrasive is used to in making grinding wheel and is used as abrasive product. It is used in abrasives, ceramics, and many high-performance uses. These materials are used in electrical conductor and have uses in resistance heating, as igniters of flame and electronic elements. Silicon Carbide Properties have low density, high strength, low thermal expansion, high hardness, high thermal conductivity and exceptional thermal shock resistance.

Silicon carbide is composed of tetrahedral carbon and silicon atoms in crystal. Sic products tough material. Sic is unaffected by any chemical or alkalis or molten salts up to 800°C. Resistance to any kind chemical reaction at temperature and strength retention at elevated temperatures has made this material very admired. Sic is used in electrical furnaces due to its high electrical conduction. CIP is a pure form of iron which is prepared by chemical decomposing of penta carbonyl. It is a grey powder having spherical micro particles. Carbonyl iron is

used in magnetic core high spherical particles of CIP are used as a part of radar used in military .CIP has high stability at high temperature. Particles of CIP (20-40%) suspended in a fluid (60-80%) are used as a MRF.

Four categories of ceramic matrix composites are classified by Niihara [2].These nano composites show improved properties both at room temperature and at high temperature. The Hybridization of both micro-nano composites is expected to give further improvement. However the synthesis of nanomaterial's for bulk production is difficult due to grain growth of initial fine particles, introduction of processing related process flaws during initial sample preparation and handling of materials on its original dimension till the final microstructure development.

II.EXPERIMENTAL WORK

Magnetic abrasive particles (MAPs) have been developed using solid phase sintering method[3]. Carbonyl iron powder of 20 volume% and SiC of 3000 mesh size with 25 volume% have been uniformly mixed in ball mill. The morphology and particle size as well as elemental composition of magnetic abrasive particles have been studied with SEM and EDS. The different phases of magnetic abrasive particles have been studied using XRD.

2.1. Composition of Powder

25 % volume fraction of SiC with 3000 mesh size and 20% volume fraction of carbonyl iron powder (CIP) of CS grade

2.2 Compaction of powder

The pellets of prepared magnetic powder have been prepared with the help of die and hydraulic jack machine by applying 8 ton pressure and this pressure has been held for 25 minutes for each pellet for getting uniform compaction.

Fig.1Hydraulic jack machine used for pellets preparation

2.3. Solid phase sintering

2.3.1 Sintering

Sintering refers to the heating of green compact in an oven .The heat is supply to unite the various grains into a single pass, thus developing the strength[4]. Sintering is done to achieve all possible final strength and hardness needed in finished product. Sintering is done by heating the compact product upto 70 to 80% of melting temperature in an inert or reducing atmosphere.

Fig.2.0 Sintering cycle

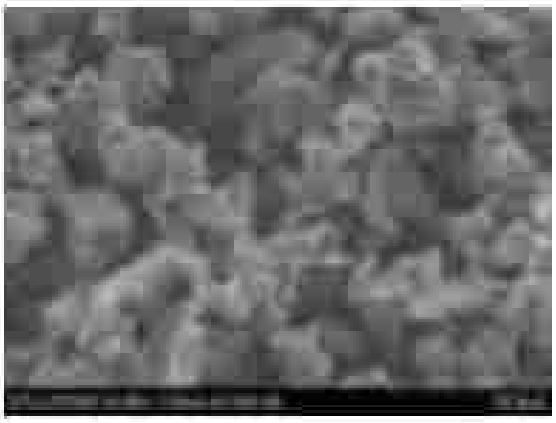

Fig. 2.1 SEM micrograph of unbonded magnetic abrasive particles

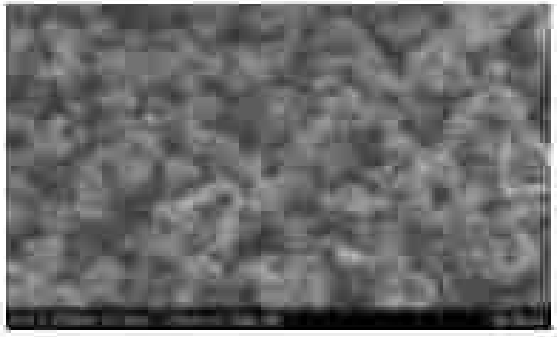

Fig. 2.2 SEM micrograph of unbonded magnetic abrasive particles

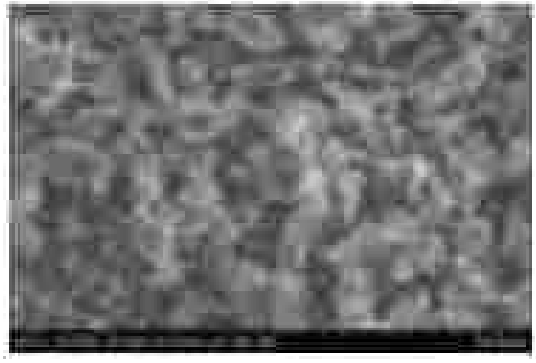

Fig. 2.3 SEM micrograph of sintered magnetic abrasive particles

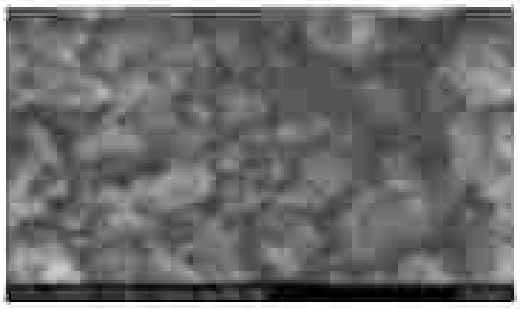

Fig 2.4 SEM micro graph of sintered magnetic abrasive particles

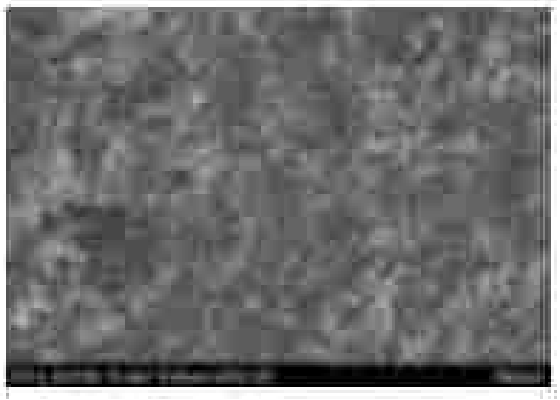

Fig.2.5 SEM micrograph of sinterid magnetic abrasive particles

III. EDS ANALYSIS

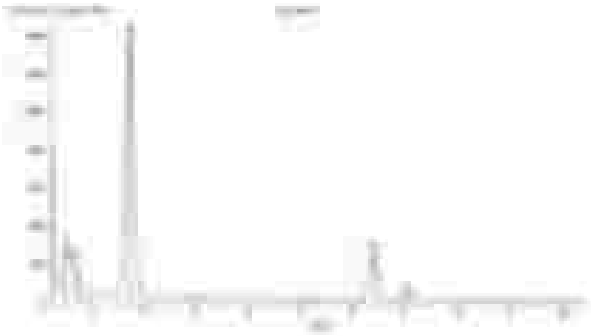

Fig. 2.6 EDS graph of solid sintered sample

Results

SEM investigates the morphology of bonded magnetic abrasive particles.SEM shows that the sharp edges of magnetic abrasive particles are obtained after crushing the sintered pellets in ball mill. The silicon carbide abrasive (SiC) particles are diffused on the surface of carbonyl iron particles during sintering and make sintered magnetic abrasive particles (MAPs). The particle size varies from 2.94 to 9.23 micron and average particle size is has been found as 6.33micron.SEM shows that the size of the particles is nonuniform. Abrasive and magnetic

particles are bonded due to bond formation between grain of SiC and CIP.There exist closeness between two particles due to very high compaction pressure.

Table 1.1 Quantitative results of EDS

IV. CONCLUSION

The present work on the powder processing and characterization onSHM, XRD and mechanical properties of SiC- CIP composite has the following conclusions.

1. TheSiC and CIP based sintered magnetic abrasive particles were developed by solid phase sintering method.

2. Scanning electron microscopy (SEM) analyses shows the morphology, shape and size of magnetic abrasive particles (MAPs) after sintering and crushing. It has been observed that the abrasive particles are diffused on the surface of carbonyl iron powder and make magnetic abrasives. The size of particles has been seen diagonally on the micrograph to calculate the average particle size. Maximum size of particle in diagonal is 0.23 micron and average particle size is 0.333 micron.

REFERENCES

1. anyanamayan c "Mechanical alloying and milling" Progress in Material Science,1-184 (2001).
2. K. Niihara, "New Design Concept of Structural Ceramics: Ceramic Nano composites", J. Ceram. Soc. 974-982 (1991).
3. Balwinder singh and balvirsingh "internal finishing of cylindrical pipes using sintered magnetic abrasive", International Journal of Engineering Science and Technology (IJEST),43-569 (2009).
4. Ramesh c.s ,srinivas k "Abrasive behaviour of laser sintered iron –Sic composite "An international journal on the science and technology of friction lubrication Wear 1777–1783 (2009).
5. R. M. German, Powder Metallurgy & Particulate Materials Processing, Princeton,New Jersey: Metal Powder Industries Federation,(2005).