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Review On Design and Analysis of 3D Printed Parts Developed Through Fusion of Composite Materials

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***Abstract-** This paper presents the development of a new composite material for use in injection molding machine. The material consists of iron powder filled in and to find out which type of composite material is best and to conduct tensile testing and fluctuation testing from a scientific point of view and to make a specimen and test it according to which type of composite material will give good 3D printing and find out the result and give a conclusion. FDM is one of the most widely used 3D printing technologies because of its reliability and simple process. FDM requires only a heating process to extrude the materials. Furthermore, FDM 3D printers have competitive prices when compared to other 3D printing machines. This is the primary reason why the FDM 3D printer is the most commercialized in the additive manufacturing industry today. Composites are becoming increasingly popular among business professionals as a way to provide high-quality materials for desired products, particularly in the aerospace and automotive industries, medical industries. Users can print lighter, stronger – sometimes even stronger than some metals – objects. The combination of two substances with different physical and chemical properties is called a compound. The most common materials for FDM 3D printing are Metal/Nylon, Metal/ABS and their various fusions. FDM printers can also print with other special materials with properties such as higher temperature, impact resistance, resistance and stiffness. In addition to commonly used materials, there are new and more effective materials that can be used in many combinations.*

As a result of this study, it was confirmed that the tensile strength of the composite decreased with the increase of metal content. In addition, the thermal conductivity of metal/polymer filaments is improved by increasing the metal content. It is believed that metal/polymer filaments can be used to print metal and large 3D (3D) models without deformation due to thermal expansion of thermoplastics.

Keywords:

Additive Manufacturing, FDM, Metal / Nylon, Metal / ABS.

I -INTRODUCTION

3D printing, also known as rapid prototypig, is a computercon trolled piecing process that uses a variety of materials and techni ques to build objects layer by layer on a machine. 3D printing ca n create physical models directly from the computer. This invent ion came about at the same time as CNC technology in the late 80's. While 3D printing isn't as popular as CNC, it has changed t he way we think about design. This ability has great power for p roduction.

In addition, 3D printing has special advantages in design, intern

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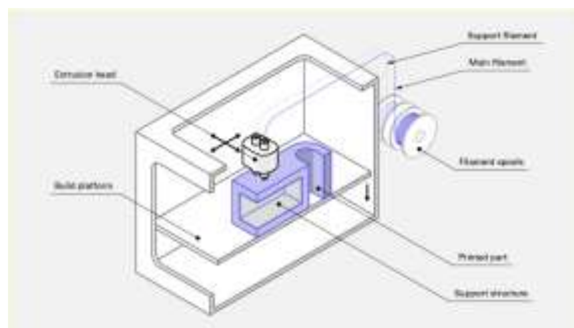
al flow channel design, cavity design, thin walls, ribs and other t hings that are difficult to do with other methods. A new metal/po lymer composite filament was developed for the Fused Depositi on Modeling (FDM) process to evaluate the thermomechanical p roperties of the new filament. Acrylonitrile butadiene styrene (A BS) thermoplastic mixed with copper and iron particles. The per centage of metal powder loaded was different to confirm the effe ct of metal on the thermomechanical properties of the fiber such as tensile strength and thermal conductivity. Compression param eters such as temperature and volume were also modified to und erstand the effect of strain parameters on the final product made with the FDM process.

SR.NO.	VARIOUS PROCESS	VARIOUS 3-D PRINTIG ADVANTAGES
1	FDM	Inexpensive, resistant components are possible
2	SLA	Less material waste, Part with high precision as well as smooth finish can be produced
3	MSLA	High resolution, resulting in parts with a smooth surface finish
4	SLS	SLS is an excellent printing technology, but it has high barriers to entry
5	DMLS	Great for producing unique shapes and designs with stable mechanical and material properties
6	SLM	Slightly larger available build volume
7	EBM	Precise and distortion free
8	MATERIAL JETTING	Very low levels of material wastage and low energy use compared to conventional manufacturing methods
9	DOD	Reducing costs, less waste, reduce time, get an competitive advantage, reduce errors, confidentiality, production on demand
11	BINDER JETTING	Very low levels of material wastage and low energy use compared to conventional manufacturing methods

As a result of this study, it was confirmed that the tensile strengt h of the composite decreased with the increase of metal content. In addition, the thermal conductivity of metal/polymer filaments is improved by increasing the metal content. It is believed that metal/polymer filaments can be used to print metal and large 3D (3D) models without deformation due to thermal expansion of t hermoplastics. [1] FDM is one of the most widely used 3D print ing technologies due to its reliability and simple operation. FD M simply uses a heat treatment to extrude the material.



Furthermore, FDM 3D printers have competitive prices when compared to other 3D printing machines. This is the primary reason why the FDM 3D printer is the commercialized in the additive most manufacturing industry today.

II-Literature Survey

[1] SEYEON HWANG,1 EDGAR I. REYES,1 KYOUNG-SIK MOON, RAYMOND C. RUMPF,3 and NAM SOO KIM1,4 "Thermo-mechanical Characterization of Metal/Polymer Composite Filaments and Printing Parameter Study for Fused Deposition Modeling in the 3D Printing Process". Journal of ELECTRONIC MATERIALS, Vol. 44, No. 3,2015 A new metal/polymer composite filament was developed for the Fused Deposition Modeling (FDM) process to evaluate the ther momechanical properties of the new filament. Acrylonitrile buta diene styrene (ABS) thermoplastic mixed with copper and iron particles. The percentage of metal powder loaded was different t

o confirm the effect of metal on the thermomechanical propertie s of the fiber such as tensile strength and thermal conductivity. C ompression parameters such as temperature and volume were als o modified to understand the effect of strain parameters on the fi nal product made with the FDM process. As a result of this stud y, it was confirmed that the tensile strength of the composite dec reased with the increase of metal content.

In addition, the thermal conductivity of metal/polymer filaments is improved by increasing the metal content. It is believed that metal/polymer filaments can be used to print metal and large 3D (3D) models without deformation due to thermal expansion of t hermoplastics. The material can also be used in 3D printed circu its and electronic models for defense and other applications.[4] Anoop K. Sood a, Raj K. Ohdar b, Siba S. Mahapatra c, “Experimental investigation and empirical modellingof FDM process for compressive strength improvement”. Received 11 October 2010; revised 18 April 2011; accepted 2 May 2011Available online 2 June 2011

Fused Deposition Modeling (FDM) has gained popularity in ma nufacturing as it has the ability to create products with complex shapes without a tool and human-machine interface. The characteristics of the FDM design enviro nment are highly dependent on the failure process, which can be improved by adjusting the parameters at the appropriate level. T he anisotropic and fragile nature of the product makes it importa nt to examine the results of the unloading process in order to im prove the service life of the workplace. Therefore, the current st udy focuses on extensive research to understand the impact of th e compressive stress of the structure on five important factors su ch as layer thickness, component design direction, grid angle, gri d width and air difference. This study not only gives an idea abo ut the success of the stress of the process, but also creates the eq uation of the prediction accuracy.

This equation is used to find parameters with the quantum best b ehavior method (QPSO). Since the FDM process is a very compl ex process and the failure process affects the nonlinear response, the compression stress is estimated using an artificial neural net work (ANN) and compared with the predicted equation. [6] C.S. Ramesha , C.K. Srinivas “Friction and wear behavior of laser-sintered iron– silicon carbide composite” Received 19 December 2008 Received in revised form 10 April 2009 Accepted 17 April 2009

Due to its ability to produce complex products in a short time, la ser sintering is currently one of the most popular methods for cr eating new materials for many high-tech industrial applications. Therefore, research papers have foc used on advanced metal matrix fabrication, choosing the laser si ntering method to create a component that eliminates slow mach ining time. Based on the above, the current work is focused on t he production of iron-silicon carbide (nickel-plated) direct metal laser sintering equipment. Laser sp eeds of 50, 75, 100 and 125 mm/s were used. Metallographic stu dies, friction and wear tests were carried out on base metals and their alloys.

The load ranged from 10 to 80 N, while the slip speed ranged fr om 0.42 to 3.36 m/s for a period of 30 minutes. By laser sinterin g, up to 7% by weight of SiC was successfully dispersed in the metal matrix.[7] 7. Kurganova Yuliya, Lopatina Yuliya, Yijin Chen “Evaluation of Filler Distribution in Particulate Reinforced Composites” Journal of Materials Science and Chemical Engineering Vol.3 No.7, July 2015. xii Aluminum-based particle-reinforced composites are important in the industry, but maintai ning the performance of such materials is difficult. The mechan ical properties of metal matrix composites are greatly affec ted by the energy dissipation in the matrix. In this study, the ho mogeneity of SiC particle distribution in Al matrix composit es made by stirred casting and powder metallurgy technique s was evaluated. Analysis is done by classical and com puterized quantitative metallographic image analysis methods. I n addition, we want to adjust the hardness distribution of the cross-sections of the sample as an indicator of the uniformity of the ar tificial material in the matrix.

[14] M. Nikzad 1 , S.H. Masood 2 , I. Sbarski3 , A. Groth45 th Australasian Congress on Applied Mechanics, Brisbane, Australia Thermo-Mechanical Properties of a Metal-filled Polymer Composite for Fused Deposition Modelling Applications , ACAM 2007 10-12 December 2007, Brisbane, Australia

The product contains metal powder and surfactant powder conta ining acrylonitrile butadiene styrene (ABS). In this study, the eff

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ect of metal powder in the polymer matrix was investigated and ABS was chosen as the matrix material. Detailed formulations o f volume percent (%v) compound ratios of various combinations of novel PMCs were evaluated experimentally. According to the results, skin.

Effect of metal filler increments on hardness, tensile and flexura l strength. The high filler metal content in the ABS composite in creases the hardness and tensile strength of the PMC product through the injection molding process.

Fig. 1 ABS Pallet

Fig. 2 Iron Powder

Fig. 3(a) Brabender Mixer (b) Compounding of Iron-ABS Material

Table I. Characteristic of compounding material

Sr. No.	Components	Melt Temperature (°C)	Density (g/cm3)
1	**Iron**	**1539**	**7.86**
2	**ABS**	**266**	**1.1**
3	**Nylon**	**256**	**1.14-1.15**
4	**Copper**	**1085**	**9**
6	**PP**	**327**	**0.90-0.92**
7	**SrTiO3**	**105-125**	**5.09**
8	**Al2O3**	**2072**	**3.987**
9	**Jute Fiber**	**105-125**	**0.935**

III-METHEDOLOGY

FDM is one of the most widely used 3D printing technologies d ue to its reliability and simple operation. FDM simply uses a h eat treatment to extrude the material. Also, FDM 3D printers are competitively priced compared to other 3D printers. This is t he main reason why FDM 3D printers are the most popular in the additive manufacturing industry today. Research data a nalysis, find out which materials are best, perform tensile and w ave tests from research findings, samples and tests based on composite materials to provide effective 3D printing results and explore and draw conclusions.3D printers are now widely used i n many research and development areas. However, the narrow n ature of 3D printing materials with limited power sources still li mits the true potential of this disruptive technology. There is an interest in improving and differentiatingthe product of general p rinted materials by introducing the material with specific produ cts and/or combining materials with differet products to produc e high performance composites. 3D printing composites are use d in many applications such as biomedical, mechanical, elect rical, thermal and optically enhanced products. The growth of 3 Dprinted composites can be attributed to the ability to create co mplex geometries, lower costs, and other advantages associate d with rapid design.

IV –CONCLUSION

After studying the literature review, to find out which type of composite material is best and to conduct tensile testing and fluctuation testing from a scientific point of view and to make a specimen and test it according to which type of composite material will give good 3D printing and find out the result and give a conclusion. FDM is one of the most widely used 3D printing technologies because of its reliability and simple process. FDM requires only a heating process to extrude the materials. Furthermore, FDM 3D printers have competitive prices when compared to other 3D printing machines. This is the primary reason why the FDM 3D printer is the most commercialized in the additive manufacturing industry today. To compare and to analyses less availability which new and more efficient composite materials can be used in various blends in addition to those in common use various blends. The main purpose of research is more advanced FDM printers can also print with other specialized materials that offer properties like higher heat resistance, impact resistance, chemical resistance, and rigidity.

V-ACKNOLEDGEMENT

Less availability which new and more efficient composite materials can be used in various blends in addition to those in common use various blends. The main purpose of research is more advanced FDM printers can also print with other specialized materials that offer properties like higher heat resistance, impact resistance, chemical resistance, and rigidity. The most common FDM 3D printing materials are Iron/Nylon,

Iron/ABS and their various blends more advanced FDM printers can also print with other specialized materials that offer properties like higher heat resistance, impact resistance, chemical resistance, and rigidity. The strength of the product develop through various 3D printing processes with filaments material (Iron/Nylon, Iron/ABS etc.) is less this study focus on to improve the tensile strength of the product.

OBJECTIVE: - 1) Improve strength of material.

2)3D printing material various process parameter

1) Nozzle size
2) Filament size
3) Melting temperature
4) Bed temperature
5) Printing speed
6) Layer thickness
7) Infill geometry
8) Infill density

3) Fix process parameters for development of 3D printed product using composite material.

4) Identification of tensile strength of product

5) Fluctuation strength

REFFERENCE

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