

**PROCESSING, CHARACTERIZATION AND
WEAR RESPONSE OF PARTICULATE FILLED
EPOXY BASED HYBRID COMPOSITES**

A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF

Doctor of Philosophy

in

Mechanical Engineering

By

Sandhyarani Biswas



**Department of Mechanical Engineering
National Institute of Technology
Rourkela, India**

September, 2010

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Submitted to

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By

Sandhyarani Biswas

(Roll No. 508ME406)

Under the supervision of

Prof. Alok Satapathy



**Department of Mechanical Engineering
National Institute of Technology
Rourkela, India
September, 2010**

Dedicated to
My Grand Father & Grand Mother



**DEPARTMENT OF MECHANICAL ENGINEERING
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ROURKELA 769008**

C E R T I F I C A T E

This is to certify that the thesis entitled **Processing, Characterization and Wear Response of Particulate Filled Epoxy Based Hybrid Composites**, submitted by **Sandhyarani Biswas** (Roll No: 508ME406) in partial fulfillment of the requirements for the award of **Doctor of Philosophy** in Mechanical Engineering to the National Institute of Technology, Rourkela is an authentic record of research work carried out by her under my supervision and guidance.

To the best of my knowledge, the work incorporated in this thesis has not been submitted elsewhere for the award of any degree.

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LIST OF FIGURES

Figure 2.1	Commonly used natural fibers and matrices for polymer composites
Figure 3.1	Bidirectional roving bamboo and E-glass fiber mats
Figure 3.2	Universal testing machine (Instron 1195) and loading arrangement for tensile and flexural tests
Figure 3.3	Schematic diagram of an impact tester
Figure 3.4	Scanning Electron Microscope (JEOL JSM-6480LV)
Figure 3.5	A schematic diagram of the erosion test rig
Figure 3.6	Solid particle erosion test set up
Figure 3.7	Linear graph for L_{27} orthogonal array
Figure 4.1	Micro-hardness of composites with different particulate fillers
Figure 4.2	Tensile strength of composites with different particulate fillers
Figure 4.3	Tensile modulus of composites with different particulate fillers
Figure 4.4	Flexural strength of composites with different particulate fillers
Figure 4.5	Inter-laminar shear strength of composites with different fillers
Figure 4.6	Impact strength of composites with different particulate fillers
Figure 5.1	Shape of the erodent used
Figure 5.2	Scheme of material removal mechanism
Figure 5.3	Resolution of impact velocity in normal and parallel directions
Figure 6.1	Effect of control factors on erosion rate (For red mud filled bamboo-epoxy composites)
Figure 6.2	Effect of control factors on erosion rate (For red mud filled glass-epoxy composites)
Figure 6.3	Interaction graph between impact velocity and filler content (A×B) for erosion rate (For red mud filled bamboo-epoxy composites)
Figure 6.4	Interaction graph between impact velocity and filler content (A×B) for erosion rate (For red mud filled glass- epoxy composites)

- Figure 6.5** Effect of impingement angle on the erosion rate of the composites
- Figure 6.6** Effect of erodent temperature on the erosion rate of the composites
- Figure 6.7** SEM graph of bamboo fiber reinforced epoxy composites
- Figure 6.8** SEM micrographs of the eroded bamboo-epoxy composites filled with red mud
- Figure 6.9** SEM images of eroded surfaces of the unfilled glass-epoxy composites
- Figure 6.10** SEM micrographs of eroded glass-epoxy composites filled with red mud
- Figure 6.11** Effect of control factors on erosion rate (For copper slag filled bamboo-epoxy composites)
- Figure 6.12** Effect of control factors on erosion rate (For copper slag filled glass-epoxy composites)
- Figure 6.13** Interaction graph between impact velocity and filler content (A×B) for erosion rate (For copper slag filled bamboo-epoxy composites)
- Figure 6.14** Interaction graph between filler content and erodent temperature (B×C) for erosion rate (For copper slag filled glass-epoxy composites)
- Figure 6.15** Effect of impingement angle on the erosion wear rate of copper slag filled bamboo-epoxy and glass-epoxy composites
- Figure 6.16** Effect of erodent temperature on the erosion wear rate of copper slag filled bamboo-epoxy and glass-epoxy composites
- Figure 6.17** SEM images of the eroded copper slag filled bamboo-epoxy composites
- Figure 6.18** Scanning electron micrograph of the glass-epoxy composite (with 10 wt% copper slag) at 43 m/sec impact velocity and erodent size 450 μm (a) erodent at room temperature and (b) erodent temperature 50°C
- Figure 6.19** Scanning electron micrograph of the glass-epoxy composite (with 10 wt% copper slag) eroded at 43 m/sec impact velocity, (a) C = 50°C, D = 90°, E = 85 mm, F = 300μm and (b) C = 60°C, D = 60°, E = 75 mm, F = 600μm
- Figure 6.20** Scanning electron micrograph of the glass-epoxy composite (with 10wt% copper slag) eroded at 60° impingement angle and erodent size 600 μm, (a) A = 54 m/sec, C = 60°C, E = 85mm and (b) A= 65 m/sec, C = 50°C, E = 65mm.

- Figure 6.21** Scanning electron micrograph of the glass-epoxy composite (with 10wt% copper slag) eroded at (a) $A = 54$ m/sec, $C = 40^{\circ}\text{C}$, $D = 90^{\circ}$, $E = 65\text{mm}$, $F = 300\ \mu\text{m}$ and (b) $A = 65$ m/sec, $C = 50^{\circ}\text{C}$, $D = 90^{\circ}$, $E = 85\text{mm}$, $F = 450\ \mu\text{m}$.
- Figure 6.22** Scanning electron micrograph of the glass-epoxy composite (with 20 wt% copper slag) eroded at 90° impingement angle and erodent size $450\ \mu\text{m}$, (a) $A = 65$ m/sec, $C = 50^{\circ}\text{C}$, $E = 75\text{mm}$ and (b) $A = 54$ m/sec, $C = 60^{\circ}\text{C}$, $E = 65\text{mm}$.
- Figure 6.23** Scanning electron micrograph of the glass-epoxy composite (with 20 wt% copper slag) eroded at 30° impingement angle, 65 m/sec impact velocity and erodent temperature 60°C , SOD 85 mm and erodent size $600\ \mu\text{m}$.
- Figure 6.24** Effect of control factors on erosion rate (For alumina filled bamboo-epoxy composites)
- Figure 6.25** Effect of control factors on erosion rate (For alumina filled glass-epoxy composites)
- Figure 6.26** Interaction graph between impact velocity and filler content ($A \times B$) for erosion rate (For alumina filled bamboo-epoxy composites)
- Figure 6.27** Interaction graph between filler content and erodent temperature ($B \times C$) for erosion rate (For alumina filled glass-epoxy composites)
- Figure 6.28** Effect of impingement angle on the erosion wear rate of the composites
- Figure 6.29** Effect of erodent temperature on the erosion rate of the composites
- Figure 6.30** SEM images of eroded surfaces of alumina filled bamboo-epoxy composites
- Figure 6.31** Scanning electron micrograph of alumina filled glass fiber epoxy matrix composite surfaces erodent at impact velocity 43m/sec , impingement angle 30° , filler content $10\text{wt}\%$, erodent temperature 60°C , erodent size $450\ \mu\text{m}$ and S.O.D 65mm .
- Figure 6.32** Scanning electron micrograph of alumina filled glass fiber epoxy matrix composite surfaces eroded at impact velocity 43m/sec , impingement angle 60° , filler content $20\text{wt}\%$, erodent temperature 60°C , erodent size $300\ \mu\text{m}$ and S.O.D 75mm .

- Figure 6.33** Scanning electron micrograph of alumina filled glass fiber epoxy matrix composite surfaces eroded at impact velocity 54m/sec, impingement angle 90°, filler content 20wt%, erodent temperature 50°C, erodent size 300µm and S.O.D. 85mm.
- Figure 6.34** Effect of control factors on erosion rate (For SiC filled bamboo-epoxy composites)
- Figure 6.35** Effect of control factors on erosion rate (For SiC filled glass-epoxy composites)
- Figure 6.36** Interaction graph between impact velocity and filler content (A×B) for erosion rate (For SiC filled epoxy composites with bamboo-fiber reinforcement)
- Figure 6.37** Interaction graph between impact velocity and filler content (A×B) for erosion rate (For SiC filled epoxy composites with glass-fiber reinforcement)
- Figure 6.38** Interaction graph between filler content and erodent temperature (B×C) for erosion rate (For SiC filled epoxy composites with bamboo-fiber reinforcement)
- Figure 6.39** Interaction graph between filler content and erodent temperature (B×C) for erosion rate (For SiC filled epoxy composites with glass-fiber reinforcement)
- Figure 6.40** Effect of impingement angle on the erosion wear rate of the composites
- Figure 6.41** Effect of erodent temperature on the erosion wear rate of the composites
- Figure 6.42** SEM micrographs of the eroded bamboo-epoxy composites filled with SiC
- Figure 6.43** SEM micrographs of the eroded glass-epoxy composites filled with SiC

LIST OF TABLES

Table 2.1	Properties of Natural Fibers [11]
Table 2.2	Comparison between natural and glass fibres [12]
Table 3.1	Copper slag generation in various regions [216]
Table 3.2	Designations and detailed compositions of the composites
Table 3.3	Parameter settings for erosion test
Table 3.4	Levels for various control factors
Table 3.5	Orthogonal array for L_{27} (3^{13}) Taguchi Design
Table 4.1	Measured and theoretical densities along with the void fractions of the bamboo-epoxy composites with different particulate fillers
Table 4.2	Measured and theoretical densities along with the void fractions of the glass-epoxy composites with different particulate fillers
Table 6.1	Comparison of erosion rates of bamboo-epoxy composites with those of glass-epoxy composites under different test conditions as per L_{27} orthogonal array
Table 6.2	ANOVA table for erosion rate (For red mud filled bamboo-epoxy composites)
Table 6.3	ANOVA table for erosion rate (For red mud filled glass-epoxy composites)
Table 6.4	Results of the confirmation experiments for erosion rate
Table 6.5	Erosion efficiency of red mud filled bamboo-epoxy composites
Table 6.6	Erosion efficiency of red mud filled glass-epoxy composites
Table 6.7	Comparison of theoretical and experimental erosion rates along with the percentage errors for red mud filled bamboo-epoxy and glass-epoxy composites
Table 6.8	Comparison of erosion rates of bamboo-epoxy composites with those of glass-epoxy composites under different test conditions as per L_{27} orthogonal array
Table 6.9	ANOVA table for erosion rate (For copper slag filled bamboo-epoxy composites)
Table 6.10	ANOVA table for erosion rate (For copper slag filled glass-epoxy composites)
Table 6.11	Results of the confirmation experiments for erosion rate

Table 6.12	Erosion efficiency of copper slag filled bamboo-epoxy composites
Table 6.13	Erosion efficiency of copper slag filled glass-epoxy composites
Table 6.14	Comparison of theoretical and experimental erosion rates along with the percentage errors for copper slag filled bamboo-epoxy and glass-epoxy composites
Table 6.15	Comparison of erosion rates of bamboo-epoxy composites with those of glass-epoxy composites under different test conditions as per L_{27} orthogonal array
Table 6.16	ANOVA table for erosion rate (For alumina filled bamboo-epoxy composites)
Table 6.17	ANOVA table for erosion rate (For alumina filled glass-epoxy composites)
Table 6.18	Results of the confirmation experiments for erosion rate
Table 6.19	Erosion efficiency of alumina filled bamboo-epoxy composites
Table 6.20	Erosion efficiency of alumina filled glass-epoxy composites
Table 6.21	Comparison of theoretical and experimental erosion rates along with the percentage errors for alumina filled bamboo-epoxy and glass-epoxy composites
Table 6.22	Comparison of erosion rates of SiC filled bamboo-epoxy against glass-epoxy composites under different test conditions as per L_{27} orthogonal array
Table 6.23	ANOVA table for erosion rate (For SiC filled bamboo-epoxy composites)
Table 6.24	ANOVA table for erosion rate (For SiC filled glass-epoxy composites)
Table 6.25	Results of the confirmation experiments for erosion rate
Table 6.26	Erosion efficiency of SiC filled bamboo-epoxy composites
Table 6.27	Erosion efficiency of SiC filled glass-epoxy composites
Table 6.28	Comparison of theoretical and experimental erosion rates along with the percentage errors for SiC filled bamboo-epoxy and glass-epoxy composites
Table 6.29	Comparison of erosion rates of bamboo-epoxy composites with different fillers
Table 6.30	Comparison of erosion rates of glass-epoxy composites with different fillers

ABSTRACT

Solid particle erosion of polymer composites is a complex surface damage process, strongly affected by material properties and operational conditions. The present research work is undertaken to study the development, characterization and erosion wear performance of bamboo fiber reinforced epoxy composites with and without particulate fillers. Attempts have been made to explore the possible use of some industrial wastes such as copper slag and red mud as filler materials in these composites. To make an assessment of their reinforcing potential in terms of wear performance and mechanical properties, two other conventional ceramic fillers such as alumina (Al_2O_3) and silicon carbide (SiC) are also considered for comparison. The mechanical properties and erosion wear characteristics of bamboo based hybrid composites are compared with those of a similar set of composites reinforced with the most commonly used synthetic fiber (E-glass). A theoretical model has been proposed for estimation of erosion damage caused by solid particle impact on bamboo fiber reinforced epoxy composites. The experimental results are found to be in good agreement with the theoretical values. This study indicates that erosion wear performance of bamboo based composites is better than that of the glass fiber reinforced composites. The morphology of eroded surfaces is examined by using scanning electron microscopy (SEM) and possible erosion mechanisms are discussed.

CONTENTS

		Page
Chapter 1	INTRODUCTION	1
	1.1 Background and motivation	1
	1.2 Thesis outline	8
Chapter 2	LITERATURE SURVEY	9
	2.1 On natural fibers and natural fiber reinforced composites	9
	2.2 On mechanical properties of natural fiber composites	13
	2.3 On bamboo and bamboo fiber reinforced composites	14
	2.4 On particulate filled polymer composites	17
	2.5 On utilization of industrial wastes like copper slag and red mud	18
	2.6 On erosion of polymer composites	21
	2.7 On erosion wear modelling	25
	2.8 Knowledge gap in earlier investigations	29
	2.9 Objectives of the present work	30
	Chapter summary	31
Chapter 3	MATERIALS AND METHODS	32
	3.1 Materials	32
	3.1.1 Matrix material	32
	3.1.2 Fiber material	33
	3.1.3 Particulate filler materials	35
	3.2 Composite fabrication	37
	3.3 Mechanical characterization	38
	3.3.1 Density	38
	3.3.2 Micro-hardness	39
	3.3.3 Tensile strength	40
	3.3.4 Flexural and inter-laminar shear strength (ILSS)	40
	3.3.4 Impact strength	41
	3.4 Scanning electron microscopy	42
	3.5 Erosion test apparatus	42
	3.6 Taguchi method	45
	Chapter summary	48

Chapter 4	RESULTS AND DISCUSSION: MECHANICAL CHARACTERIZATION	49
	4.1 Density and void fraction	49
	4.2 Micro-hardness	50
	4.3 Tensile properties	51
	4.4 Flexural strength	54
	4.5 Inter-laminar shear strength (ILSS)	55
	4.6 Impact strength	56
	Chapter summary	57
Chapter 5	DEVELOPMENT OF A THEORETICAL MODEL FOR EROSION WEAR RATE ESTIMATION	59
	5.1 Nomenclature	59
	Chapter summary	65
Chapter 6	RESULTS AND DISCUSSION: EROSION WEAR CHARACTERISTICS	66
	6.1 PART 1: RED MUD FILLED COMPOSITES	66
	6.1.1 Taguchi experimental analysis	66
	6.1.2 ANOVA and the effects of factors	70
	6.1.3 Confirmation experiment	72
	6.1.4 Effect of impingement angle and erodent temperature on erosion	74
	6.1.5 Erosion efficiency	75
	6.1.6 Surface morphology	79
	6.2 PART 2: COPPER SLAG FILLED COMPOSITES	86
	6.2.1 Taguchi experimental analysis	86
	6.2.2 ANOVA and the effects of factors	89
	6.2.3 Confirmation experiment	91
	6.2.4 Effect of impingement angle and erodent temperature on erosion	92
	6.2.5 Erosion efficiency	94
	6.2.6 Surface morphology	96
	6.3 PART 3: ALUMINA FILLED COMPOSITES	102
	6.3.1 Taguchi experimental analysis	102
	6.3.2 ANOVA and the effects of factors	105
	6.3.3 Confirmation experiment	106
	6.3.4 Effect of impingement angle and erodent temperature on erosion	107
	6.3.5 Erosion efficiency	109
	6.3.6 Surface morphology	112

6.4	PART 4: SiC FILLED COMPOSITES	117
6.4.1	Taguchi experimental analysis	117
6.4.2	ANOVA and the effects of factors	122
6.4.3	Confirmation experiment	123
6.4.4	Effect of impingement angle and erodent temperature on erosion	125
6.4.5	Erosion efficiency	127
6.4.6	Surface morphology	129
6.5	Relative effect of different fillers	133
	Chapter summary	135
Chapter 7	SUMMARY AND CONCLUSIONS	136
7.1	Summary of research findings	136
7.2	Conclusions	139
7.3	Recommendations for potential applications	141
7.4	Scope for future work	142
	REFERENCES	143
	APPENDICES	
	A 1. List of Publications	
	A 2. Brief Bio Data of the Author	
	Prints of Published Papers	