THE INFLUENCE OF SLAG AND PSAC ON THE WEAR RESISTANCE OF COMPOSITE ALUMINIUM

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

There are many situations in engineering, that none of the single material can fulfill the design requirements and specific applications. The developments of products technology now require the unique material properties. It cannot be fulfilled by conventional metal alloys, ceramic and polymer materials. For example, in the aerospace industry an engineer looking lightweight materials, strong, rigid, good abrasion resistance and able to withstand the impact.

The term “composite” broadly refers to a material system which is composed of a discrete constituent (the reinforcement) distributed in a continuous phase (the matrix), and which derives its distinguishing characteristics from the properties of its constituents, from the geometry and architecture of the constituents, and from the properties of the boundaries (interfaces) between different constituents. Composite materials are usually classified on the basis of the physical or chemical nature of the matrix phase, e.g., polymer matrix, metal-matrix and ceramic composites. In addition there are some reports to indicate the emergence of interring metallic-matrix and carbon-matrix composites. This review is concerned with metal matrix composites and more specifically on the aluminum matrix composites (AMCs). In AMCs one of the constituent is aluminum/aluminum alloy, which forms percolating network and is termed as matrix phase. The other constituent is embedded in this aluminum/aluminum alloy matrix and serves as reinforcement, which is usually non-metallic and commonly ceramic such as SiC and Al2O3.[1] Properties of AMCs can be tailored by varying the nature of constituents and their volume fraction. The major advantages of AMCs compared to unreinforced materials are as follows:

I. Greater strength
II. Improved stiffness
III. Reduced density(weight)
IV. Improved high temperature properties
V. Controlled thermal expansion coefficient
VI. Thermal/heat management
VII. Enhanced and tailored electrical performance
VIII. Improved abrasion and wear resistance
IX. Control of mass (especially in reciprocating applications)
X. Improved damping capabilities.

Aluminum-based materials studied seriously to replace iron-based materials in internal combustion engines. Based on research, one of the main driving force for the development of an aluminum matrix composite technology with ceramic particles are noted from the results of the composite have the high wear resistance and therefore the potential for a number of materials tribological applications.

Applications commonly practiced in the automotive industry is the piston, cylinder block and disk break. The use of aluminum composite can improve the performance of a vehicle as it is lighter than steel.

2.2 Aluminum Composite

A composite material can be defined as a combination of two or more materials that results in better properties than those of the individual component used alone. In contrast to metallic alloys, each material retains its separate chemical, physical and mechanical properties. The two constituents are reinforcement and a matrix. The main advantages of composite materials are their high strength and stiffness with bulk materials, allowing for a weight reduction in the finished part.[2]

Researchers at Delft University of Technology have created aluminum composite material that is stronger than carbon fiber, costs less to manufacture, weighs 20% less and is immune to metal fatigue. It is being billed as a material that could revolutionize the airline industries, saving $100 billion worldwide.