ACKNOWLEDGEMENT

I have a great pleasure in expressing my deep sense of gratitude and indebtedness to Dr. Qasim Murtaza (Associate Professor) of Mechanical Engineering Department of Delhi College of Engineering for their continuous guidance and invaluable suggestion and time at all stages from conceptualization to experimental and final completion of this project work. They have guided me for fundamentals and provided many technical papers on the subject matter and thus inculcated the interest and quest for knowledge of this work. He provided constant support and encouragement for successful completion of this work.

I am also grateful to Prof. B.D Pathak Head Department of Mechanical Engineering, for providing the experimental facilities in various labs of the Department.

I also have great respect and indebtedness for Mr. Rajesh Bora and Mr. Ajay Kumar, for their support and facilities provided for experiments, required for the completion of this special subject.

My special thanks to Mr. Gopal Arora (PhD. Scholar DCE, Delhi) for his valuable time for guiding me and given his very useful critical comment on the work and help me to do the project work on time.

I am also thankful to all the lab assistants of my college help me.

At the last but not the least to my friends Mr. K.V.R.S Prashant, Mr. Yash Gupta, Mr. Sanket Katiyar and my family members who always give me strength and moral support to complete the work.

DALIP KUMAR

ABSTRACT:

Aluminum alloy coating of compositions, aluminum 98.76%, magnesium 0.81%, and manganese 0.41% was successfully prepared by two wire arc sprays on the graphite substrate. There are different thermal spray processes such as combustion flame spray, high velocity oxy- fuel spray, plasma spraying , vacuum plasma spraying and cold sprays. But the coating produced by two wire arc spray has less porosity (1-2% only) and the process can be performed under controlled conditions. The graphite substrate was used because the coating after solidification does not adhere. After solidification the coating was removed from the graphite substrate. It was then cut having a diameter 5 cm and pasted over a sheet of diameter 17 cm with the help of araldite. There are different wear tests such as scratch test, slurry abrasion test, erosion test and pin on the disc test. The selection of the wear test depends on the material of the coating and its applications. For marine applications of the coating, slurry erosion and corrosion test are preferred. But in case of dry applications of the coating the pin on disc and scratch test are commonly perform. For the present study two variables were selected for wear test; load (29.4, 44.1 and 58.8 N) and sliding speed (150, 200 and 250 rpm). To find the significant variables which affect the wear rate and coefficient of friction of the coating ANOVA was designed. Wear test of the coating was conducted on pin on disc machine under dry conditions. And wear rate calculated using mass loss methods. The wear disc was weight before and after the wear test on an electronic balance having least count of 0.0001g. The coefficient of friction was found with LVDT which gave the frictional force during wear test. The surfaces morphology of worn surfaces of the coating was analysed with scanning electron microscope. The XRD of the worn surfaces was done to determine the change in intermolecular spacing of the worn surfaces of the coating. The wear rate of the coating was found to be increased with increased in load as well as sliding speed. The co-efficient of friction of the coating was found to decrease with increased load and sliding speed. The d-spacing of the coating molecules on the wear track was found to decrease with increased load. The microstructure of the worn surfaces of the coating was also examined with optical telescope and no change in microstructure of the coating due to frictional heat was found. The micro hardness at the cross section of the coating at wear track was found to decrease away from the wear track. The main wear mechanism examined by scanning electron microscope was adhesion, deformation and microcutting.

Key words: Two wire arc spray, pin on disc, microstructure, wear rate, aluminum alloy coating.

CONTENTS

LIST OF FIGURE

LIST OF TABLES

ABBREVIATIONS

Symbol	Explanation
μ	co-efficient of friction
Φ	pin diameter
g	grams
Kg	kilogram
N	load in Newton
Hv	Vickers microhardness
μm	Micrometer
A˚	Armstrong
d	Intermolecular distance
θ	Angle of incidence
3D	Three dimensional
D_1, D_2	Diagonals of indenter
Rpm	Revolution per minute
SEM	Scanning electron microscope
XRD	X-ray diffractometry
EDS	Electronic dispersive spectrometry
ANOVA	Analysis of variance