CERTIFICATE

Date:

This is to certify that report entitled **"MAGNETORHEOLOGICAL CHARACTERIZATION OF MRP FLUID AND MR FINISHING"** by **Mr. KRISHNA PRATAP SINGH,** is the requirement of the partial fulfillment for the award of Degree of **Master of Technology (M. Tech.)** in **Production Engineering** at **Delhi Technological University, Delhi.** This work was completed under our supervision and guidance. He has completed his work with utmost sincerity and diligence. The work embodiedin this project has not been submitted for the award of any other degree to the best of my knowledge.

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ABSTRACT

Magnetorheological (MR) fluids are the suspensions of micron-sized dispersed magnetic phase in a non-magnetic carrier continuous phase along with additives. Magnetic abrasive particles (MAPs) based MR polishing (MRP) fluid sample has been synthesized in the present research work. These MAPs are developed at 1000^0C with appropriate sintering cycle using solid phase sintering method. Then MRP fluid sample has been synthesized with 45 volume% magnetic abrasive particles and 55 volume% base fluid. After synthesis of MRP fluid, magnetorheological characterization has been done at different magnetic field on MCR-301 magnetorheometer and steady state rheograms have been drawn. The flow behavior of magnetic abrasive particles (MAPs) based MRP fluid sample has been compared with flow behavior of unbonded magnetic abrasives based MRP fluid. The result shows better yield behavior and viscosity of MAPs based MRP fluid sample as compared to unbonded magnetic abrasives based MRP fluid.

After magnetorheological characterization, the experiments have been conducted on mild steel work-piece surface having 70x10x5 mm dimension with MAPs based MRP fluid sample as well as unbonded magnetic abrasives based MRP fluid on ball end magnetorheological finishing (BEMRF) tool. Initial surface roughness before experiment and final surface roughness after the experiments has been measured with Talysurf using 4 mm data length and 0.25 mm cut off length. The percentage reduction in surface roughness ($\%\Delta R_a$) has been calculated and found better for finishing the mild steel surface by MAPs based MRP fluid sample as compared to unbonded magnetic abrasives based MRP fluid.

Key words: MAPs, MR, MRP Fluid, Magnetorheology, Surface roughness

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

NOMENCLATURE

VOL	Volume
CIP	Carbonyl iron powder
°C	Degree Celsius
Mm	Millimeter
MR	Magnetorheological
MAP	Magnetic abrasive particle
MRP	Magnetorheological Polishing
XRD	X-ray diffraction
N	Newton
τ	Fluid shear stress (Pa)
τ_o	Dynamic yield shear stress (Pa)
SEM	Scanning Electron Microscope
η	Plastic viscosity (Pa−s)
γ	Shear rate (s^{-1})
ΔRa	Surface Roughness
H	Magnetic field intensity
Ω	Angular velocity
θ	Angular displacement