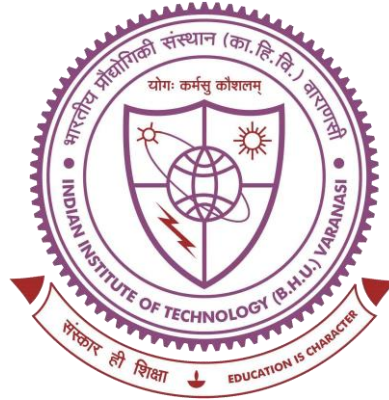


Pelletization and Reduction of Multi Metallic Magnetite Iron Ore Fines



Thesis submitted in partial fulfillment
for the award of degree

Doctor Of Philosophy

by

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CERTIFICATE

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It is further certified that the student has filled all the requirements of the comprehensive examination, candidacy, and SOTA for the award of a Ph.D. degree.



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(BISWAJIT MISHRA)

Dedicated

To

My Beloved Parents

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Abbreviations

AI	Abrasion Index
ASTM	American Society for Testing and Materials
BHJ	Banded Hematite Jasper
BHQ	Banded Hematite Quartzite
BIF	Banded Iron Formation
BSS	British Standard Sieve
Bt	Billion Tonnes
CCS	Cold Crushing Strength
CMC	Carboxy Methyl Cellulose
cps	Counts Per Second
DR	Direct Reduction
DRI	Direct Reduced Iron
EDS	Electron Dispersive Spectrometry
eqn.	Equation
FC	Fixed Carbon
GDP	Gross Domestic Product
GHG	Green House Gas
HCVTM	High Chromium Vanadium Titanium Magnetite
IMMT	Institute of Minerals and Materials Technology
IS	Indian Standards
LD	Linz-Donawitz converter
LOI	Loss on Ignition
M	Metal
MMO	Multimetallic Magnetite Ore
MO	Metal Oxide
Mt	Million tonnes
NEIST	North East Institute of Science and Technology
NML	National Metallurgical Laboratory
OES	Optical Emission Spectrometry
RDI	Reduction Degradation Index
RO	Oxide of Reducing agent
RRL	Regional Research Laboratory

Abbreviations

SEM	Scanning Electron Microscope
SI	Shatter Index
Temp	Temperature
TFe	Total Iron content
TI	Tumbler Index
UTM	Universal Testing Machine
VM	Volatile matter
VTM	Vanadium Titanium Magnetite
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence

Symbols

wt. %	Weight percentage
°C	Degree Celsius
vol. %	Volume percentage
%R	Percentage Reduction
% Fe _M	Percentage Metallization
KJ/mole	Kilo Joule per mole
α	fraction of reduction
k	slope of plotted lines
t	time
Kg, kg	Kilo gram
L/min	Litre per minute
H ₂ -DRI	Hydrogen gas Reduced MMO pellets
C-DRI	Carbon Reduced MMO pellets
mm	Millimeter
ml	Millilitre
μm	Micrometer
kV	Kilo Volt
mA	Mili Ampere
λ	Wavelength
mins	Minutes
dia	Diameter
ρ	Density
gm	Grams
kN	Kilo Newton
Fe(M)	Metallic Iron
Fe(T)	Total Iron
N	Normality
ΔG°	Standard Free energy of Formation
ΔG_r	Standard Free energy of reaction
R ² , rsqr	Goodness of Fit
(g)	gas