

IV Year II Semester

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**POWDER METALLURGY
(Professional Elective-IV)**

Unit I

Introduction

Historical and modern developments in Powder Metallurgy. Advantages, limitations and applications of Powder Metallurgy. Basic Steps for Powder Metallurgy.

Characteristics of metal powder

Chemical composition, Particle size, shape and size distribution, Characteristics of powder mass such as apparent density, tap density, flow rate, friction index. Properties of green compacts and sintered compacts

Unit II

Metal powder production methods

Atomization, Reduction from oxide, Electrolysis, Crushing, Milling, Condensation of metal vapour, Hydride and carbonyl processes, Mechanical Alloying, New developments.

Unit III

Powder Characterization

Powder conditioning, fundamentals of powder compaction, density distribution in green compacts, compressibility, green Strength, pyrophorocity and toxicity.

Unit IV

Powder Compaction Methods

Basic aspects, types of compaction presses, compaction tooling and role of lubricants, Single and double die compaction, isostatic pressing, hot pressing.

Unit V

Powder Forming

Powder rolling, powder forging, powder extrusion and explosive forming technique.

Sintering

Definition, stages, effect of variables, sintering atmospheres and furnaces, Mechanism, liquid-phase sintering, Secondary operations.

Unit VI

Sintered Products

Study of sintered bearings, cutting tools, metallic filters, friction and anti friction parts and electrical contact materials. Defects in Powder metallurgy processed materials and their processing to minimize defects: Friction stir processing etc.

Text Books:

1. Introduction to Powder Metallurgy, A. K. Sinha, Dhanpatrai Publication
2. Powder Metallurgy: Science, Technology, and Materials, Anish Upadhyaya, Gopal Shankar Upadhyaya, CRC Press
3. Powder Metallurgy: Science, Technology and Applications, P. C. Angelo, R. Subramanian

Reference Books:

1. Powder Metallurgy, W.D.Jones
2. Principles of Powder Metallurgy, T.Shukerman
3. Handbook of Powder Metallurgy :- H.H.Hausner
4. Powder Metallurgy, ASM Handbook, Vol-VII.

Course Outcome:

After learning the course the students should be able to:

1. Acquire the knowledge of Powder Metallurgy History, Applications and its importance.
2. Measure the various powder characteristics like apparent density, tap density, flow rate, friction index.
3. Acquainted the knowledge of metal powder production methods.
4. Aware about the powder characterization techniques.
5. Understand the basic methods of Powder compaction for green compact.
6. Familiar about compaction tooling and role of lubricants in compacting.
7. Explain various powder forming techniques other than the compaction.
8. Explain the mechanism of sintering and types sintering for development of mechanical properties.
9. Understand the application in various fields of powder metallurgy
10. Understand causes of defects in Powder metallurgy processed materials and method to minimize defects.