

## PPH440: MATERIALS PROCESSING

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**Course Objectives:** The course aims at imparting understanding to the students of metals and ceramics processing as well as regarding the influence of different processing parameters on microstructures.

**Solidification from Liquid and Vapour Phase:** Nucleation and growth, Homogeneous and heterogeneous nucleation, Interface stability, Development of micro structure, Faceted and non-faceted structure, Super cooling, Equilibrium phase diagrams, Eutectic and peritectic solidifications and their microstructures, Foundry techniques such as sand casting, Permanent mould casting, Investment casting and die casting, Casting defects and their inspection.

**Forming Processes:** Fundamentals of metal forming, Hot working process; Rolling, Forging, Extrusion, Piercing, Cold working processes; Bending, Shearing, Squeezing etc.

**Metals Processing:** Welding, Brazing, and soldering: Conventional and Laser techniques and their application

**Ceramic Processing / Powder Processing:** Synthesis of common ceramic powders such as  $\text{Al}_2\text{O}_3$ ,  $\text{ZrO}_2$ ,  $\text{Si}_3\text{N}_4$ , and  $\text{SiC}$ , Powder characterization, Binders, Lubricants, Defloculants and flocculants as processing aids, shaping techniques such as powder compaction, Extrusion, Injection moldings, Slip casting, Solid state and liquid phase sintering, machining of ceramic components, Common applications such as cutting tools, Ferrites and piezoelectric.

### **Course Learning Outcomes (CLO):**

Students will have understanding of:

1. how to adopt proper working conditions for a particular material to be used in different engineering components;
2. different ceramic powders and bulk by different processing techniques.

### **Recommended Books:**

1. Chalmner, B., *Principles of Solidification*, Wiley, (1977).
2. Degarmo, E.P., Black, J.T. Koshner R.A, *Materials and Processing in Manufacturing*, Prentice-Hall of India, (1986).
3. Martin, D.H. & Jones, *Polymer Processing*, Chapman and Hall, (1989).
4. Fleming, M.C., *Solidification Processing*, McGraw Hill, (1974).
5. Richerson, B.W., *Modern Ceramic Engineering: Properties, Processing and Use in Design*, Marcel Dekker, (1983).