

OBJECTIVE

To enable the students to have a thorough knowledge on the advanced processing techniques in ceramics.

OUTCOME

On completion of the course the students are expected to

- Have a thorough knowledge on the preparation of ceramic powder by mechanical and chemical methods.
- Have studied the additives used in ceramic forming and different ceramic forming processes in dry powder, slurry and plastic consistency.
- Have a better understanding on the mechanisms of solid state and liquid phase sintering, and crystal growth during sintering.
- Have learnt the advanced sintering processes and their mechanisms.
- Have understood the processes involved in machining and surface finishing of ceramic products.

UNIT I POWDER PROCESSING

Powder preparation by mechanical methods – comminution, mechano-chemical synthesis. Powder synthesis by chemical methods – solid state reaction, liquid solutions, vapour phase reactions. Synthesis of nano scale ceramic powder–liquid solution technique, vapour phase technique.

UNIT II FORMING

Additives in ceramic forming – solvents, dispersant, binder, plasticizer, other additives. Forming of ceramics – dry and semidry pressing - die compaction and isostatic compaction; casting methods - slip casting, pressure casting, gel casting, electrophoretic deposition; plastic forming methods - extrusion, co-extrusion, injection molding, solid freeform fabrication - particle filled polymer methods, powder methods, suspension methods- Porous ceramic forming- foaming, intrusion, organic additives.

UNIT III SINTERING MECHANISMS

Solid state sintering – driving force, effect of surface curvature and boundary defects, mechanism, stages of sintering. Liquid phase sintering – stages, kinetic and thermodynamic factors, phase diagram in liquid phase sintering. Grain growth – different grain growth process, control of grain growth, grain growth and pore evolution in a porous compact, interaction between pore and grain boundary.

UNIT IV ADVANCED SINTERING

Pressure assisted sintering – hot pressing and hot iso-static pressing. Reaction bonded sintering, microwave sintering.

UNIT V MACHINING AND SURFACE FINISHING OF CERAMICS

Mechanism of material removal and its effect on strength, surface grinding and mechanical polishing, non abrasive finishing, ceramic surface coating, joining of ceramics – metal ceramic joints.

TEXT BOOKS

1. Mohamed N.Rahaman, Ceramic Processing, Taylor & Francis, 2007.
2. David W. Richerson, Modern Ceramic Engineering, 3rd Edn., Taylor & Francis, 2005.

REFERENCES

1. Paul De Garmo E, Black J.J and Ronald A.Kohser, Materials and Processes in Manufacturing, 8th Edn., Prentice – Hall India Pvt. Ltd., New Delhi, 1997.
2. Reed J.S, Introduction to the Principles of Ceramic Processing, Wiley, New York, 1988.
3. John G.P.Binner (Ed), Advanced Ceramics Processing and Technology, Noyes Publications, New Jersey, 1990.
4. Burtrand Lee and Sridhar Komarnei (Eds.), Chemical Processing of Ceramics, 2nd Edn., Taylor & Francis, 2005.