Subject Code : P8CHE3

SOLID STATE CHEMISTRY

UNIT 1

Concepts and Languages of supramolecular chemistry. Various types of non-covalent interactions. Hydrogen bonds, C-H…X interactions, Halogen bonds. π – π interactions,non – bonded interactions. Various types of molecular recognition.

Crystal engineering of Organic solids: Hydrogen bonded supramolecular patterns involving water / carboxyl / halide motifs. Concepts of different types of synthons based on non-covalent interactions. Principles of crystal engineering and non-covalent synthesis. Polymorphism and Pseudopolymorphism. Supramolecular isomorphism / polymorphism. Crystal engineering of pharmaceutical phases.

UNIT II

M.O.F (Metallo Organic Frame works), Organometallic systems. Combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. Design of nanoporous solids. Inter ligand hydrogen bonds in metal complexes – implications for drug design. Crystal engineering of NLO materials, OLED.

UNIT III

Preparative methods in solid state chemistry:

General principles of solid state chemistry - Experimental procedure, Coprecipitation as a precursor to solid state reaction, Other precursor methods, Kinetics of solid state reactions - Crystallizations of solutions, melts, glasses and gels,Solutions and gels : zeolite synthesis, Melts, Glasses - Vapour phase transport methods - Modification of existing structures by ion exchange and intercalation reactions,Graphite intercalation compounds, Transition metal dichalcogenide and other intercalation compounds, Ion exchange reaction, Synthesis of new metastable phases by 'Chimie Douce' - Electrochemical reduction methods - Preparation of thin films,Chemical and electrochemical methods, Physical methods - Growth of single crystals,Czochralski method,Bridgman and stockbarger methods, Zone melting, Precipitation from solution or melt : flux method, Epitaxial growth of thin layers, Verneuil flame fusion method, Vapour phase transport , Hydrothermal methods, Comparison of different methods - High pressure and hydrothermal methods, Hydrothermal methods, Dry high pressure methods.

UNIT IV

Magnetic Materials:

Selected examples of magnetic materials, their structures and properties - Metals and alloys, Transition metal oxides, Spinels, Garnets, Ilmenites and

perovskites, Magnetoplumbites - Applications: structure/property relations: Transformer, Information strorage, Magnetic bubble memory devices, Permanent magnets.

Optical Properties: Luminescence, Lasers : Luminescence and phosphors - Definitions and general comments, Configurational coordinate model, Some phosphor materials, Anti-Stokes phosphors – Lasers-The ruby laser,Neodymium lasers

UNIT V

Organic solid state chemistry:

Topochemical control of solid state organic reactions: Intramolecular reactions : conformational effects , Intermolecular reactions : moleculare packing effects,Photodimerization of o-ethoxy-trans-cinnamic acid (α form, β form, γ form),Photopolymerization of 2, 50distyrylpyrazine, Photopolumerizations of diacetylenes,Assymetric syntheses, Dimerization of anthracene – role of crystal defects, Control of molecular packing arrangements, Organic reactions within inorganic host structures - Electrically conduction organic solids : organic metals, Conjugated systems, Doped polyacetylene, Polyparaphinylene , Polypyrrole. - organic charge transfer complexes : new superconductors

References:

1. Lehn, J.M. Supramolecular Chemistry, VCH, Wienheim, 1995.
2. Desiraju, G.R. Crystal Engineering: The Design of Organic Solids,Elsevier, Amsterdam, 1989.
3. Desiraju, G.R. & Steiner, T. The weak Hydrogen Bond in Structural Chemistry and Biology: Oxford University press: Oxford, 1999.
4. Jeffrey, G. A. Introduction to Hydrogen Bonding ; Oxford University press: New York, 1997.
5. Lehn, J.M. Transition metals in supramolecular chemistry : John Wiley & sons: New York, 1999.
6. Desiraju, G.R. (2001). Current Science, 81, 1038.
7. Rao, C.N.R. (2001). Current Science, 81, 1030.
8. Solid state chemistry and its applications by Anthony R.West, John Wiley & sons (For Unit III – V, Page no. (562-593,666-679))
9. "Molecule Matters" Saravanakumar, k & Sankararaman, (2007).Resonance, Vol.12, No 11, Page 77.
10. Journals
    (i) Crystal Growth and Design.
    http://www.pubs.acs.org/journals/cgdefu/index.html
    (ii)Crystal Engineering Communication,
    http://www.rsc.org/Publishing/Journals/ce/index.asp