

Nanostructures and Nano Materials (RP 4.2.13)

Nanostructured Materials: Concept of quantization; length scales; Review of structures and properties of Semiconductor Heterostructures, Quantum Wells, Supperlattices, Quantum Wires and Dots; Effect of strain on properties of semiconductor nanostructures; Review of growth techniques.

Different Materials: Nitride and Carbide semiconductors, Applications, Ceramic materials, Superconducting materials, HTS materials, Josephson junction, SQUIDs, Conducting polymers, Hybrid circuit materials, Fibre optic materials, Electro-optic materials, Microwave materials

Nanoelectronic Materials: High-k dielectrics and silicides for nano-scale CMOS; Group IV alloys for electronic and photonic devices. Nitride based materials and structures for blue-green lasers, solar blind photodetectors. Materials combinations for mid and long infrared and THz communication.

Nanocomposites: CNTs, magnetic materials, magnetic materials

Carbon Based Materials and structures for emerging electronics: Basic structure; chirality; Metallic and Semiconducting Nanotubes; Transport and mobility; CNT FETs; Other applications; Graphene: basic properties, application in electronics and other areas. Materials for magnetoelectronics and spintronics: Basic concept of electron spin; Spin dependent transport in structures; Spin valves; Giant magnetoresistance; Application in computer storage and memory. Magnetic tunnel junctions and MRAMs; Semiconductor spintronics; Spin FET and other devices; applications; Magnetic semiconductors.

Metamaterials: Electromagnetic metamaterials; Negative refractive index; Classification: negative index, EM band gap, double +ve, chiral; Split-ring resonator; Applications; THZ-, Photonic Band Gap-, Tunable-, Frequency Selective Surface(FSS)-based metamaterials; Absorbers; Superlens; Cloaking devices; Metamaterial antenna. Molecular Electronics: Materials and structures; transport; Mobility; Electronic and Photonic Device applications.

Smart Materials: Piezo-electric; Piezo-resistive; Piezo-restrictive; Magneto-strictive; Magneto-resistive properties; Shape Memory Alloys; Magnetically Activated Shape Memory Alloys; Active Fiber Composites; Electro and Magneto-Rheological Fluids; Smart Gels and Shape Memory Polymers; Sensors and Actuators; Applications in Electronics and Photonics.