

Research Interest

Key words: Condense matter, soft condensed matter and nanostructured physics, Surface science X-ray scattering, HRTEM, XAS (EXAFS, NEXAFS), Miniaturised Mössbauer spectroscopy.

Executive Summary

The major focus of my research interests will center on nanosciences using an interdisciplinary approach to meet the objectives of the project assigned. Nanoscale science is extremely interesting and offers exciting opportunities to develop novel materials for technological applications owing to the useful and exploitable properties of nanomaterials. These properties can be harnessed at the molecular level to develop new molecules by using various approaches such as grafting, templating or surface functionalisation by other molecules.

My research interest will reflect both, fundamental and applied aspects of various nanosolids, their hybrid materials and complex liquids. The major areas of my study will center on :

(a) **Nanostructured solids and complex Liquids:** synthesis of various nanosolids such as nanoparticles, nanorods, nanosheets, and their surface functionalization with organic and complex inorganic molecules. Modification of their respective surfaces will be interesting to develop novel molecules and will help to understand the effect of surface modifications, solid-liquid and solid-solid interfaces dispersions, their interaction with dispersant media. The study will expose their potential use in magnetic, tribological, environmental and biotechnological applications as hybrid smart materials.

The other important aspect is the determination of the structure of these nanosolids/molecules using modern microscopic and spectroscopic techniques such as X-ray absorption spectroscopy (XAS, EXAFS, NEXAFS), mossbauer spectroscopy, high resolution electron microscopy, X-ray Scattering (SAXS, WAXS) etc. Furthermore, along with the detailed structural understanding I would be interested in studying their respective interesting properties of these nanosolids and nano hybrids/molecules so that they can be used for various magnetic and energy applications.

Investigations will be conducted on complex nano liquids to develop new materials and to understand basic properties and structure-property correlations with the aim of exploiting the materials for industrial applications.

(b) **Application of nanostructured materials:** My interest also extends to studying thin films and assembled layers of these nanosolids/molecules and complex liquids with special reference to understanding the nucleation and growth mechanism, investigations of Ostwald ripening of growth islands and vacancies that may be attributed to a number of parameters of the deposition and surface reconstruction of the films. It would be of further interest to determine the atomic exchange between the film and substrate i.e. diffusion phenomenon between film and substrate and effect of interlayer on thin films of these nanosolids/ complex liquids. My future aim would be to focus on developing an interest in the growth and characterization of novel materials for technological advancement and highlighting significant applications to exploit the properties of nano-materials, ferrofluids. The emphasis will therefore initially focus on understanding of the structure-property relationships of material systems and development of new and viable industrially compliant materials.