REPORT

TWO DAYS TRAINING PROGRAM

ON

NANOLAB

4th – 5th December 2014

Organized

By

Department of Nanoscience and Technology

Bharathiar University

Coimbatoe 641 046

&

JSS University

Mysore 570 015

Venue

Department of Nanoscience and Technology

Bharathiar University

Coimbatore 641 046

Two days Practical Training program on Nano Lab

4-5th December, 2014.

A workshop on "Two days Practical Training program on Nano Lab" was conducted by Department of Nanoscience and Technology, Bharathiar University, Coimbatore and JSS University, Mysore during the period of 4-5th December 2014. The main aim of the Workshop was to provide the hands on training to the students for nanomaterial characterization and pharmaceutical applications. Dr D. Mangalaraj, Head, Department of Nanoscience and Technology, Bharathiar university, Coimbatore welcomed the gathering, Dr Dhanabal, Principal, JSS Pharmacy College, Ooty gave an explanation for the MoU signed by both the Institutions. Dr. K. Gowthamarajan, Professor and Head, Department of Pharmaceutics and Dr. N. Ponpandian, Professor, Department of Nanoscience and Technology gave the genesis of the workshop and highlighted the importance and need of nanotechnology.

Dr N. Ponpandian has delivered a talk on X-Ray diffraction (XRD). Dr R.T. Rajendra Kumar has presented the potential applications of Scanning Electron Microscopy in research. Dr D. Nataraj has given a talk on Photoluminescence and UV-Visible Spectroscopy. Dr. Y.L. Jeyachandran has delivered a talk on Raman and FTIR spectroscopy. All the presentations were followed by hands on training on corresponding equipments in the afternoon sessions.

The facilities, chemicals and consumables were sponsored by Department of Nanoscience and Technology, Bharathiar University, Coimbatore.

45 delegates from various institutes from all over India were participated. The Workshop was concluded with the vote of thanks by Dr. K Gowthamarajan.

Session I

Presenter: Dr. N. Ponpandian

Topic: X-Ray diffraction (XRD)

X-ray powder diffraction is a non-destructive technique widely applied for the characterization of crystalline materials. The method has been traditionally used for phase identification, quantitative analysis and the determination of structure imperfections. In recent

years, applications have been extended to new areas, such as the determination of crystal sizes and the extraction of three-dimensional microstructural properties. The method is normally applied to collect data under ambient conditions, but *in-situ* diffraction as a function of an external constraints (temperature, pressure, stress, electric field, atmosphere, etc.) is important for the interpretation of solid state transformations and materials behaviour. Various kinds of micro- and nano-crystalline materials can be characterised from Xray powder diffraction, including inorganics, organics, drugs, minerals, zeolites, catalysts, metals and ceramics. The physical states of the materials can be loose powders, thin films, polycrystalline and bulk materials. For most applications, the amount of information which is possible to extract depends on the nature of the sample microstructure (crystallinity, structure imperfections, crystallite size, texture), the complexity of the crystal structure (number of atoms in the asymmetric unit cell, unit cell volume) and the quality of the experimental data (instrument performances, counting statistics).

Session II

Presenter: Dr. R.T. Rajendra Kumar

Topic: Scanning Electron Microscopy (SEM)

A SEM Consists of a source (electron gun) of the electron beam which is accelerated down the column. A series of lenses (condenser and objective) which act to control the diameter of the beam as well as to focus the beam on the specimen. A series of apertures (micron-scale holes in metal film) which the beam passes through and which affect properties of that beam. Controls for specimen position (x, y, z height) and orientation (tilt, rotation). An area of beam/specimen interaction that generates several types of signals that can be detected and processed to produce an image or spectra and all of the above maintained at high vacuum levels (the value of the upper column being greater than the specimen chamber.

Session III

Presenter: Dr. D. Nataraj

Topic: Photoluminescence and UV-Visible Spectroscopy

Fluorescence occurs when a molecule absorbs light photons from the u.v.-visible light spectrum, known as excitation, and then rapidly emits light photons as it returns to it’s ground state. Fluorimetry characterizes the relationship between absorbed and emitted

photons at specified wavelengths. It is a precise quantitative analytical technique that is inexpensive and easily mastered. This chapter outlines the basic concepts and theories on instrument setup and fluorescent dyes in solution. All chemical compounds absorb energy which causes excitation of electrons bound in the molecule, such as increased vibrational energy or, under appropriate conditions, transitions between discrete electronic energy states. For a transition to occur, the absorbed energy must be equivalent to the difference between the initial electronic state and a high-energy state. This value is constant and characteristic of the molecular structure. This is termed the excitation wavelength. If conditions permit, an excited molecule will return to ground state by emission of energy through heat and/or emission of energy quanta such as photons. The emission energy or wavelength of these quanta are also equivalent to the difference between two discrete energy states and are characteristic of the molecular structure. Fluorescence occurs when a molecule absorbs photons from the u.v.-visible light spectrum (200-900 nm), causing transition to a high-energy electronic state and then emits photons as it returns to its initial state, in less than 10-9 sec. Some energy, within the molecule, is lost through heat or vibration so that emitted energy is less than the exciting energy; i.e., the emission wavelength is always longer than the excitation wavelength. The difference between the excitation and emission wavelengths is called the Stokes shift.

Session IV

Presenter: Dr. Y.L. Jeyachandran

Topic: Raman and FTIR spectroscopy

Raman spectroscopy is a form of vibrational spectroscopy, much like infrared (IR) spectroscopy. However, whereas IR bands arise from a change in the dipole moment of a molecule due to an interaction of light with the molecule, Raman bands arise from a change in the polarizability of the molecule due to the same interaction. This means that these observed bands (corresponding to specific energy transitions) arise from specific molecular vibrations. When the energies of these transitions are plotted as a spectrum, they can be used to identify the molecule as they provide a “molecular fingerprint” of the molecule being observed. Certain vibrations that are allowed in Raman are forbidden in IR, whereas other vibrations may be observed by both techniques although at significantly different intensities thus these techniques can be thought of as complementary. Since the discovery of the Raman effect in 1928 by C.V. Raman and K.S. Krishnan, Raman spectroscopy has become an

established as well as a practical method of chemical analysis & characterization applicable to many different chemical species.


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