FIBER COUPLED RAMAN MICROPROBE

The Raman Microprobe facility was established in 2008 at the Materials Science Programme and Advanced Center for Materials Science with financial support under the CARE scheme of IIT Kanpur. This instrument allows non-destructive characterization of materials using inelastic light scattering methods. Microprobe allows data collection from very small sample sizes (as small as ~ 100 microns). The spectrum provides a method to obtain information about the local structure at the nanoscale by recording the lattice vibrational spectrum. A comparison with known standards allows quantification of information obtained such as ratio of crystalline to amorphous phases and determination of the diameter of single walled carbon nanotubes. The instrument is currently installed in the Laboratory for Materials at Extreme Conditions.

Unique features: Raman microprobe is a standalone microscope in which the excitation source (Argon ion laser at 514.5 nm) is fiber coupled into the microscope and the scattered light is filtered and the Rayleigh background minimized by using a razor edge sharp filter (see Figure 1). The cleaned up signal is then sent through another optical fiber to a monochromator. This monochromator enables light to be dispersed using a diffraction grating and anlaysed for its spectral response using a charge coupled device photon detector. The digital data collected in real time is displayed on the computer attached to the instrument and can be ported to other computer applications for further processing. The microscope is also equipped with another camera allowing visualization of the analysed location.

Figure 1: Fiber coupled Raman Microscope.

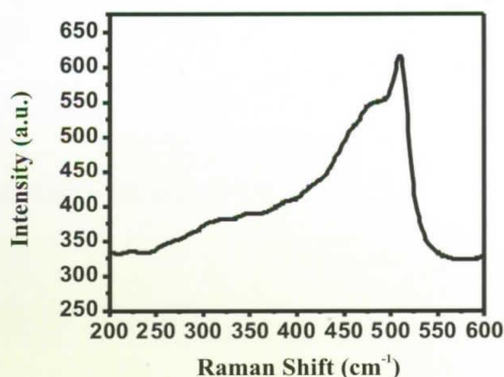

Figure 2: Raman spectrum of nanocrystalline silicon grown by PECVD method. Fraction of crystalline phase was determined to be 16% using Raman microscope.

This facility is currently being used by a number of research groups across departments within campus. We are in the process of adding capabilities to do measurements at low temperature and high pressures. This would further increase the reach of this probe enabling mapping of complex phase diagrams of materials as function of external perturbations. To illustrate the capability, Raman spectrum of nanocrystalline Si showing broad Raman band is presented in Figure 2.

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