Glantreo Ltd Physical Chemistry Analytical techniques

Technique	Principle Applications	Description	Sample Requirements	Comments/Limitations
Scanning Electron Microscope (SEM)	Micron to sub-micron sample morphology and topography information. Equipped with EDS (elemental analysis) capability.	Secondary and backscattered electrons are used to generate 3D-like, high-resolution images.	Non-volatile solid sample	Magnification 50X to 200,000X. 5 nm resolution.
Energy Dispersive Spectroscopy (EDX or EDS)	Spatially resolved near surface (depth of a few microns) elemental analysis for detection of elements B to U. Point, line scan and mapping capabilities.	Sample is irradiated with x-rays generated in an electron microscope. Characteristic x-rays are measured based on the energy of the emitted x-rays.	Solid, non-volatile sample.	Part per thousand detection limits. Semi quantitative. 250 nm spatial resolution.
Electron Spectroscopy for Chemical Analysis (XPS)	Surface elemental and bonding information including element identification, depth profiling and element mapping.	Sample is irradiated with x-rays and the emitted photoelectrons are measured as a function of binding energy.	Sample must be a vacuum stable, clean solid.	Part per thousand detection limits. 30 micron lateral resolution; 30-50 Angstrom probe depth resolution.

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Transmission Electron Microscope (TEM)	Provision of fine, microstructure information including filler/phase dispersion and crystallinity.	High energy electrons are transmitted through a thin sample to obtain highresolution images.	Most solids and liquids. Cryo microtome and cryo plunge sample preparation.	Extensive sample preparation may be required. ~2 Angstrom resolution.
X-ray Diffraction (XRD)	Identification of crystalline compounds, crystalline size and percent crystallinity.	The angle and intensity of x-rays diffracted from a material are measured.	Crystalline solids, partially crystalline polymers and crystalline containing liquids.	Generally nondestructive technique.
Particle Size Analysis	Provision of Particle Size of sample	Laser light scattering is utilised to measure the particle size of the sample	Dry powders and liquid dispersions	Sample can be reclaimed
Microanalysis	Determination of %C, %H, &N and &S within a sample	Combustion techniques are employer to determine the percentages of certain elements within a saple	Solid samples	Destructive
Surface area measurements (BET)	Determination of surface area, pore volume and pore diameters within a samples	Nitrogen adsorption is utilised to determine the physiochemical properties of a samples	Solid/powder samples	Non destructive
Differential Scanning Calorimetery (DSC)	Determining melting points/phase inversion temperature/impurities etc	DSC directly measures heat changes that occur in sample during controlled increase or	Solid and liquid samples	May be particular useful with polymer species/destructive

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		decrease in temperature,		
Thermal Gravimetric Analysis (TGA)	Determines % water in a polymer sample	A sample is heated and its weight/mass is constantly monitored	Solids	Destructive
Viscosity Measurements (via Brookfield)	Determine the viscosity within a liquid/viscous solution	Brookfield rotational viscometers measure viscosity by sensing the torque required to rotate a spindle at constant speed while immersed in fluid	Liquids	Non destructive
Inductively Coupled Plasma (ICP)	Determination of ppm/ppb levels of elements within a sample	ICP is a type of emission spectroscopy that uses the inductively coupled plasma to produce excited atoms and ions that emit electromagnetic radiation at wavelengths characteristic of a particular element.	Liquids or solids that are easily digestible	Can generally determine to a ppb level any element within a liquid or solid sample. Solid sample generally need digestion

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