Research interests

Synchrotron radiation assisted X-ray absorption spectroscopies.

- **EXAFS (**Extended X-ray Absorption Fine Structure): EXAFS spectroscopy determines the materials nanostructure, as that is determined by nearest neighbor distances and coordination numbers at distances up to the 4^{th} nearest neighbor shell. EXAFS does not require long range periodicity and thus it can be applied to both crystalline and amorphous materials.
- **NEXAFS (**Near-edge X-ray absorption fine structure): NEXAFS spectroscopy maps the density of empty states (DOS) of the absorbing atom in the conduction band. In addition to that it gives information on the symmetry around the absorbing atom, its valence, the bond orientation and defect related states.
- **Micro-EXAFS & micro-NEXAFS**: using appropriate capillary optics the beam diameter is reduced to 1.5-5 μm. Therefore EXAFS and NEXAFS spectra can be recorded from pre-selected spots of the sample. The micro- option is particularly useful in the study of inhomogeneous samples.

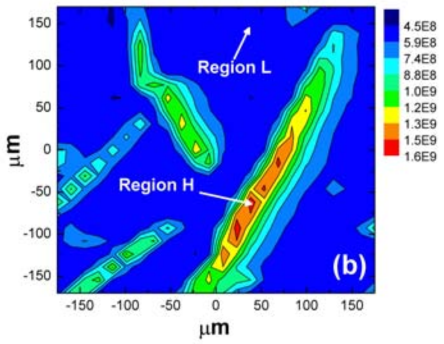
EXAFS & NEXAFS are non-destructive and atom-selective.

We studied:

- The effect of growth conditions and chemical composition in the nanostructure of SiN_x και SiO_yN_z thin films that were grown using PECVD, plasma enhanced thermal nitridation and ion implantation.
- The nanostructure of GaN, AlN, InN, AlGaN, InGaN as well as the effect of growth conditions, impurities and ion implantation.
- Stabilized industrial waste vitreous and vitroceramic materials, which contain heavy and toxic metals. The wastes originated from the oil and steel industries.

Synchrotron radiation assisted XRF & XRF mapping

SR-XRF is used for the determination of the materials chemical composition and mapping of the elemental distribution with high spatial resolution (1.5-5μm). It has been applied in stabilized industrial wastes and biological samples. A representative XRF map of the inhomogeneous Fe distribution in stabilized industrial wastes is shown in the following figure. (from: F. Pinakidou et al, J. Non Crystalline Solids **351**, 2474 (2005)).



Plasma technology

We studied the effect of RF glow discharge in materials growth as well as in the modification of bulk and surface properties. More precisely we studied the effect of plasma on: (1) growth of thin SiN_x films; (2) passivation of deep traps in III-V semiconductors; (3) bulk and surface properties of SiC.

Electrical properties of electronic materials and devices.

We studied the bulk and surface electronic properties of insulator-semiconductor & metal-semiconductor structures as well as III-V heterostructures (SiN_x, GaInP, GaInAs, a-SiC and GaInP HEMT).

Auger, XPS and Raman spectroscopies:

Auger spectroscopy was extensively used for the determination of the composition of thin SiN_X films grown on Si in a nitrogen glow discharge. XPS was implemented in the study of the effect of hydrogen plasma on the bulk and surface properties of SiC. Raman was employed for the study of size-effects in the vibrational properties of Si powders, characterization of thin SiN_x films and the study of ion implanted GaN.

Physical properties

Differential scanning calorimetry, chemical etching, oxidation resistance of SiN_x films.