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Course no-CA5030

APPLICATION OF XPS TECHNIQUE.

X-ray photoelectron spectroscopy (XPS) is a technique for analysing the surface chemistry of a material. XPS can measure the elemental composition, empirical formula, chemical state and electronic state of the elements within a material. XPS spectra are obtained by irradiating a solid surface with a beam of X-rays while simultaneously measuring the kinetic energy and electrons that are emitted from the top 1-10 nm of the material being analysed. A photoelectron spectrum is recorded by counting ejected electrons over a range of electron kinetic energies. Peaks appear in the spectrum from atoms emitting electrons of a particular characteristic energy. The energies and intensities of the photoelectron peaks enable identification and quantification of all surface elements (except hydrogen).

As the demand for high performance materials increases, so does the importance of surface engineering. Many of the problems associated with modern materials can be solved only by understanding the physical and chemical interactions that occur at the surface or at the interfaces of a material's layers. The surface chemistry will influence such factors as corrosion rates, catalytic activity, adhesive properties, wettability, contact potential and failure mechanisms.

The material's surface is the point of interaction with the external environment and other materials. Therefore, surface modification can be used in a wide variety of applications to alter or improve the performance and behaviour of a material. XPS can be used to analyse the surface chemistry of a material after an applied treatment such as fracturing, cutting or scraping. From non-stick cookware coatings to thin-film electronics and bio-active surfaces, XPS is the standard tool for surface material characterization.

Application of xps technique

~~Xsp~~ Xps imaging has therefore understanably found their application in the area of Oxidation, corrosion, and Magnatism. Surface binding and diffusion..

like -

1) Biological arrays-

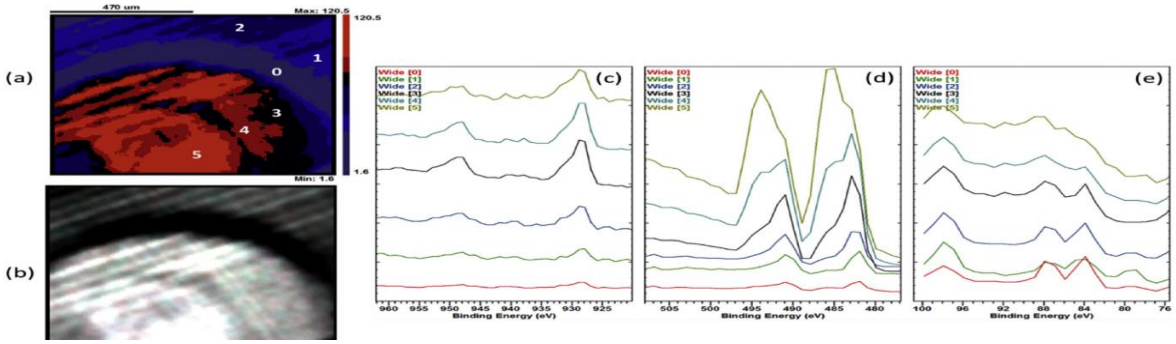
One powerful feature of imaging xps is the ability to perform both elemental & chemical state imaging to map the localisation of a given moiety.

This may achieve through imaging of Binding Energy corresponding to a unique element or chemical distmet fragment. which itself is sufficently shifted from elemental backbone of the molecule.

) failur analysis and corrosion? -

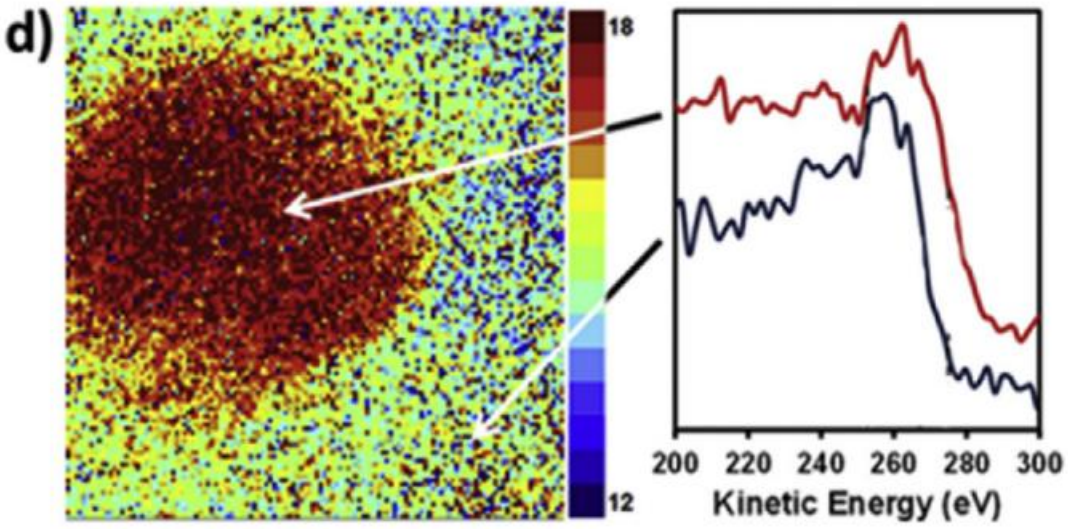
One of the gratest issue industry faces is the failure of manufactured parts. which is typically caused by oxidation and corrosion.

Imaging xps has been applied to several system including adhesive joint failure printing corrosion in inconel, Ni-Cr-no alloys and the analysis of laminated channelplates.



Applications to carbon based technologies

For analysis of carbon materials, imaging XPS has already been applied by researchers, where the analysis of conductive carbon within an epoxy matrix, has been studied and mapped through utilisation of differential charging of the two different components . To further map such carbon variances, Barlow and co-



workers derived the so-called Multivariate Auger Feature Imaging (MAFI) method for differentiating between sp2 and sp3 carbon, through imaging the x-ray induced C(KLL) auger feature, which itself is derived from the work of Lascovich et al. Who derived the “D-parameter” to quantify the amount of sp2 carbon present in a sample. Fig shows the results from Barlow’s D-parameter imaging of a graphitic flake immobilised on conductive carbon tape taken from. Application of the MAFI technique, clearly provides strong and unambiguous identification of areas of varying sp2 content in a rapid fashion. There is clear scope for exploitation of this technique where extended graphite/graphene networks are used, such as graphene based electronics.

XPS Applications in the Metal/Steel Industry

XPS is a fundamental characterization tool for investigating a wide range of surface problems on metal and oxide surfaces. With its surface selectivity and quantifiable data, XPS is the ideal tool for measuring composition and thickness of protective oxide films on metals. In addition, sputter profiling the steel surface provides a full understanding of the surface composition and chemistry, which may help to diagnose failures in the passivation process. Finally, XPS can detect any contaminants that may have been introduced during the manufacturing process.