

APPLICATION NOTE

Phosphorous Content in Electroless Nickel Directly Measurable

Phosphorous, the concentration of which significantly influences the mechanical and magnetic properties of a coating, is incorporated when using typical methods for electroless or chemical deposition of nickel. Measurement of the phosphorous content has therefore been an issue ever since electroless Ni was first introduced for technical applications.

Until now, X-ray fluorescence analysis – widely used in the electroplating industry for coating thickness measurement and coating analysis – was only able to determine phosphorous concentration indirectly through evaluation of the substrate material's signal, restricting the applicability of the technique to systems with substrates consisting of only one heavy element. Furthermore, a minimum coating thickness of about 4 μm was required.

However, using the FISCHERSCOPE® X-RAY with high resolution silicon drift detectors (SDD), the fluorescence signal of phosphorous can be measured directly, as long as the excitation conditions are selected correctly.

The information depth is very superficial: Fluorescence radiation from only the uppermost 1 μm enters into the spectra evaluation; therefore, interference from diffraction reflex can largely be excluded. The measurement uncertainty of the phosphorous content is about 0.5 mass per cent.

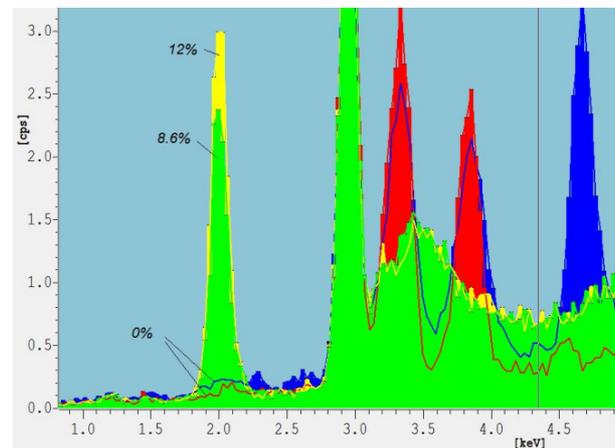


Figure 2: Overlap of 3 spectra with different phosphorous content. Height of the phosphorous peaks at 2 keV varies significantly.

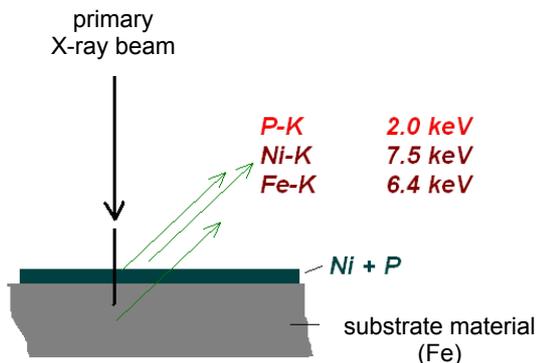


Figure 1: Coating model and schematic of the fluorescence excitation.

Because measuring the thickness of a NiP coating is performed under different excitation conditions than determination of the concentration of P, these two measuring applications complement each other. Traceability can be ensured by using the respective calibration standards (with Fe, Cu, Al and PCB as substrate materials) from FISCHER.

The combination of state-of-the-art detector technology such as SDD, multiple excitations in various modes, and the powerful analysis software, WinFTM®, allows for reliable, accurate measurements of both coating thickness and phosphorous content of electroless nickel coatings on a wide variety of substrate materials. The FISCHERSCOPE® X-RAY XDV®-SDD unites all these performance features in one instrument.