QUANTIFICATION OF TWO POLYMERIC PHASES IN PAINT FORMULATION BY X-RAY FLUORESCENCE AND X-RAY PHOTOELECTRON SPECTROSCOPY

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Fluoropolymer based paints are among the most durable of coatings, hence their widespread use in architectural applications. Paint formulations involve the blending of several polymeric phases, stabilizers and pigments. Due to their complexity it is of interest to have a variety of analytical techniques available for quality control testing of the final paint compositions. We report on recent efforts aimed at using X-ray techniques such as X-ray fluorescence (XRF) and X-ray photoelectron spectroscopy (XPS) to measure the fluorine and oxygen contents of a series of clear coat fluoropolymer films. The objective of the work is to develop calibration curves to quantify a fluoropolymer and an acrylic phase over a wide range of concentrations. Each of the two X-ray approaches presents advantages and drawbacks linked to sample size and shape, coating condition, penetration and escape depth of X-rays in thin film, and speed of analysis. Promising results were obtained with the XRF method, which allowed quantification of the two polymer phases. The two-sigma calibration curve error for the fluoropolymer is 3.5 wt% over a range from 0 wt% to 100 wt%, and the calibration error for the acrylic phase is 4 wt% for a range extending from 0 wt% to 100 wt%. While the XPS method for quantifying the fluoropolymer phase indicated a better accuracy initially, actual samples produced larger errors. Samples exposed to the environment may still be quantified by XPS but the measurement should be conducted on a cleaned sample surface and the information from different signals (C, O, F) could be combined to produce a more robust calibration.

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