QUANTIFICATION OF SULFUR CONTENT IN POLYMER FILMS OF VARYING THICKNESSES USING X-RAY FLUORESCENCE

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The compositional analysis of polymer films by X-ray fluorescence presents numerous advantages over other analytical techniques. XRF can easily process large numbers of samples with minimal sample preparation and lead to more representative results because of the larger size of the probed specimen. The analysis of thin films by XRF is even made easier because matrix effects can be ignored. Challenges arise however when the analyst is working with thick films and non-infinite thickness conditions. Film thickness variation will directly impact intensities, even of light elements, as polymer matrices have a low average atomic number. We worked on an XRF method to measure sulfur content in multi component polymer films having various thicknesses and designed an approach to correct for the effect on sulfur intensities. While film thicknesses were typically ranging from 15 μm to 60 μm the required accuracy on sulfur determination was to be around 5% relative at a two-sigma error regardless of thickness. Considering it would be inefficient to produce a set of calibration standards for the various thicknesses of interest, we took a different approach. We used X-ray excitation/absorption formalism to calculate a correction factor for sulfur intensities based on the film thickness. The correction is calculated in a spreadsheet and is made simple enough for routine usage. While approximations were taken, comparison of XRF experimental data with elemental analysis data typically shows a good agreement that falls within the desired accuracy. We also checked that the thickness correction procedure could predict a good sulfur concentration for a stack of thin films with only a few percent relative errors.

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