

# **SYNTHETICALLY GENERATED REFERENCE SPECTRA FOR X-RAY FLUORESCENCE CALIBRATION WITH APPLICATION TO THE ON-LINE MEASUREMENT OF FLUORO-CHEMICAL CONCENTRATION ON CARPET FIBERS**

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Determination of chemical compositions using X-ray fluorescence (XRF) involves comparing measured spectra of unknown concentrations to spectra from known calibration samples. Measurement accuracy greatly depends on the chemical and physical similarities between the calibration and unknown samples. Ideally, XRF samples should have smooth, flat surfaces with base chemical constituents identical to those of the calibration samples. When XRF is utilized to determine the amount of chemical treatments applied to carpet fibers, an extensive set of calibration samples would normally be required, i.e., separate samples for each carpet fiber type, tufting pattern, backing type and surface sculpting style. The cost and time required to prepare such sample sets make the application of XRF prohibitively expensive for the carpet industry.

The research presented introduces a new methodology to synthetically generated reference spectra using XRF spectra from standard fluorochemical solutions and from base carpet samples for each carpet type to be tested. Thus, actual physical standards are not required for each carpet type or style. Accomplishing this is still a challenging problem because XRF spectra contain a background continuum and characteristic peaks from all the materials in the carpet fibers and backing, and spectra shapes also change with physical construction of the carpet.

Results presented suggest the use of an XRF instrument is practical as a near real time screening tool to measure the concentration of fluorochemicals applied to carpet fibers, since the generation of synthetic reference spectra greatly reduces the number of required calibration samples. This work also introduces an alternative methodology as an alternative to the commonly used fundamental parameter method for performing XRF calibrations when physical reference samples are not available. To evaluate the performance of the synthetically generated reference spectra, the calibration results were compared with the industry standard chemical burn test certified by the American Association of Textile Chemists and Colorists (AATCC) test to show results are an acceptable alternative to the AATCC test.