Investigation of Spectral Line Shapes in Asphalt Binders by X-ray Diffraction Patterns Using Pearson-VII Pseudo-Voight and Generalized Fermi Functions

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ABSTRACT: Asphalt binders of twenty-three samples were obtained from Alberta, Northern Ontario, Canada, Montana USA, and Venezuela. Thin films samples (1mm) were prepared by heating onto glass slides at 150˚C for 10 min. X-ray diffraction (XRD) patterns were obtained using monochromatic Cu-K-α radiation at 40kV and 40mA on Rigaku DMax 2200V-PC. Profile fitting was performed using Pearson VII and Pseudo-Voigt functions over 5˚ to 35˚ and 60˚ to 110˚= 2θ. Furthermore, to our knowledge, it is the first time we introduced XRD spectra modeled using a Generalized Fermi Function (GFF) for asphalt binders. The analysis of the diffraction line broadening in x-ray thin film is analytically calculated and simulated using these functions. The results showed a correlation among Pearson VII, Pseudo-Voigt and GFF.

X-ray line broadening investigations from the integral width or the full width at half maximum (FWHM) of the diffraction line is used for approximation of the experimental x-ray line profiles obtained from the samples. Asphalt binder samples measured by x-ray diffraction on thin asphalt films, are identified as two factors that correlate reasonably well with aging tendency at low temperatures. From the application perspective, cracking in asphalt pavements in colder climates and rutting in hot climates are ongoing problems. Therefore, investigation and understanding of structural and compositional properties of asphalt binders at the microscopic level is aimed at improving the performance and durability of asphalt pavements.

ALL ARE WELCOME!!!