

Bitumen Ageing determined by fluorescence spectroscopy

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Bitumen is a specific demand orientated product from crude oil refinery and the main application is as binder for asphalt (mixture of bitumen and mineral aggregates). During service lifetime ageing is one contributor among others that causes the road construction to fail.

By comparing fluorescence emission spectra of non-aged and aged bitumen a difference in the spectra can be elaborated. Non-aged bitumen shows higher intensity than aged bitumen. Aged bitumen obtained through laboratory techniques, extraction of bitumen from a pavement core sample and from test field asphalt plates, shows that with increasing ageing duration (equivalent to increasing time or temperature during laboratory ageing) the obtained fluorescence signal decreases. Similar results apply for excitation spectra.

To avoid the influence of different lamps, sample preparation and sample settings inside the measurement chamber, which affect the signal intensity and makes differentiation of ageing stages impossible, the obtained spectra were normalized. The slope of the spectra provided a good indication for the ageing stage and in the case of the investigated bitumen two appearing peaks could be linked to ageing.

Additionally examination of the bitumen fraction (asphaltenes, resins, aromatics and saturates) obtained by solubility in n-heptane and liquid column chromatography revealed that the aromatic fraction exhibits the highest intensity of all fractions and its amount decreases during ageing. Hence a correlation between fraction and spectra is possible.