Time dependent studies of bitumen surface with FTIR

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Bitumen is a product from the crude oil refining process used mainly as the binder in asphalt pavement. Therefore, it is constantly surrounded by the atmosphere, which contains traces of highly reactive oxygen species (ROS) that are responsible for oxidation. These chemical reactions cause ageing, which changes the mechanical properties of bitumen, as it gets stiffer and more brittle. To connect the changes in mechanical properties and chemical composition, different rheological, spectroscopic and microscopic methods have been developed and applied, respectively. Amongst all, infrared spectroscopy is the one used most, due to the fact, that a qualitative and quantitative analysis of constituents and emerging functional groups is achievable.

The bitumen samples investigated in this work were derived from three different refineries and attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR) and dynamic shear rheometer (DSR) were used for analysis. Time dependent studies were implemented, where multiple samples with constant layer thickness were prepared and measured with FTIR and DSR within a timespan of a week. The purpose of this approach was to find notable changes on the surface and correlate it to its bulk behaviour. As a matter of concern, a proper use of FTIR spectroscopy, sample preparation, sample storage and the evaluation of the spectra will be discussed thoroughly.