

Fluorescence scanner for bitumen quality control

Handy, mobile, robust and fast – designed for the entire supply and processing chain

As one of the most versatile construction materials, bitumen is used as a binding agent in road construction, a sealing material, an adhesive or to provide corrosion protection. A complex, organic mixture of substances, bitumen loses its desired properties as it ages, either due to environmental impacts or on account of processing-related errors. In order to determine the extent of the ageing and to find out the quality of the material, quality measurements need to be performed after every processing step.

Each year, 102 million tonnes of bitumen are used worldwide, 85% of which is for road construction and approx. 10% of which is for roofing. A tonne costs between around EUR 300 and EUR 500. A large proportion of maintenance costs relating to road construction and other applications can be saved if only bitumen which has undergone quality checks is used.

Objective

There are over 100 different, standardised procedures for measuring the quality of bitumen. However, they can only be performed by qualified experts in a laboratory. Realising quality assurance at various stages in production, delivery and processing, however, requires a mobile, fast, easy-to-use, yet reliable measurement method.

Technology

A reliable method for chemical analysis, which has already proven successful in many different applications, is fluorescence spectroscopy. Unlike purely mechanical measurement methods, it enables conclusions to be drawn concerning the bitumen's chemical composition and thus also its degree of ageing. Research conducted by Prof. Hinrich Grothe and his team at TU Wien has led to the development of a suitably easy-to-handle scanner. It uses conventional LEDs to stimulate the bitumen's fluorescence, a photomultiplier (PMT) to capture the reflection, and software developed in-house to interpret the measurement results.

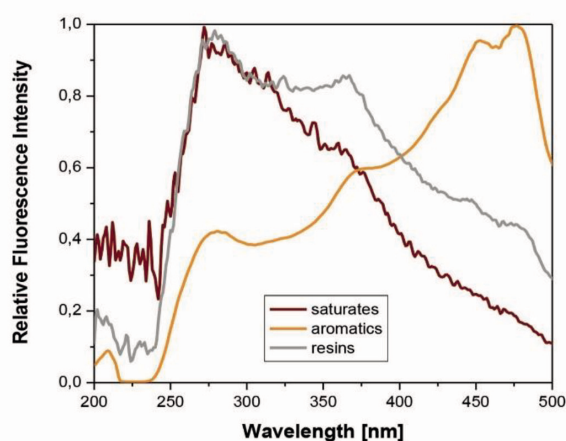


Advantages of the fluorescence scanner

- The world's first fast and reliable testing system, which doesn't require laboratory conditions or any highly specialised professionals
- Short measurement process lasting just a few seconds
- Convenient handling and flexible applications due to compact design
- Robust and mobile scanner ideal for outdoor use
- No elaborate training required thanks to easy-to-understand operation
- Straightforward quality control for buyers, processors, on-site inspectors and vendors
- Reduced follow-up costs based on the use of bitumen that has undergone quality checks and/or thanks to the swift rectification of defective processes
- Increased customer loyalty for suppliers due to certification of the quality of their bitumen

Target groups

- Construction companies, contracting authorities, and road and motorway operators
- Companies which use bitumen in anti-moisture and anti-corrosion applications for buildings and technical components
- Producers and processors of bitumen, and operators of mixing plants



Typical spectral lines of bitumen's major components

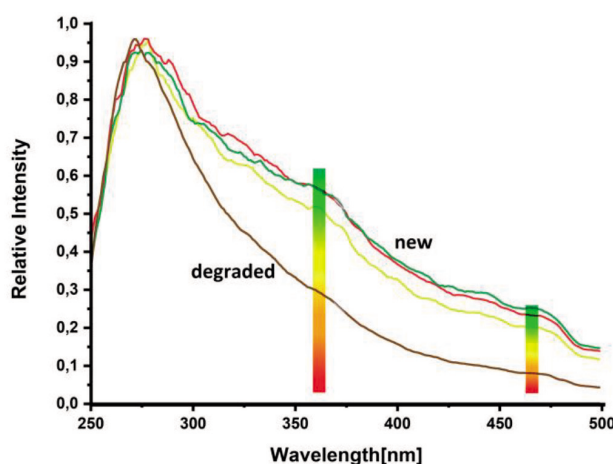
Approach

The research teams of Prof. Hinrich Grothe at the Institute of Materials Chemistry and of Prof. Bernhard Hofko at the Institute of Transportation at TU Wien focused their research on the ageing of bitumen and potential ways of measuring it. As bitumen ages, its composition changes, specifically the proportions of alkanes, aromatic hydrocarbons, resins, and asphaltenes.

Fluorescence spectroscopy represents a new approach to measuring these proportions. Prof. Grothe has previously used it to successfully identify soot particles in the stratosphere and analyse their composition.

Whilst asphaltenes don't fluoresce, alkanes, aromatic hydrocarbons and resins are easy to detect with the help of fluorescence spectroscopy. They display fluorescence within the visible spectral range.

Aged samples display significantly different spectra to unaged samples. It has been shown that only few excitation wavelengths are important in terms of quality control, as their emission intensity correlates directly with the bitumen's degree of ageing. It is therefore not necessary to incorporate the entire spectrum. Excitation with wavelengths in the blue, violet and ultraviolet range is sufficient for ascertaining the quality of bitumen.



Fluorescence spectra of bitumen from various road surfaces

These findings were used to develop a portable and handy scanner, which can perform these measurements in just a few seconds.

This means that, for the first time ever, quality control can be carried out on every step in the entire production, processing and supply chain of bitumen.

Notes

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