

Fluorescence scanner for bitumen quality control

Handy, mobile, robust and fast

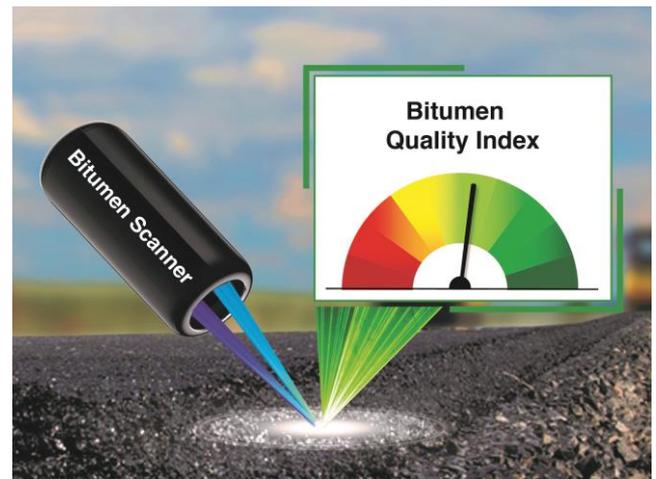
Bitumen, one of the most versatile construction materials, is being used as a binding agent for road construction, sealing material, adhesive or corrosion protection. As a complex, organic mixture of substances, bitumen loses its desired properties when it ages, either because of environmental impacts, or, because of manufacturing faults. In order to determine the extent of aging and to ensure the material quality, it is thus necessary to perform quality measurements after every processing step.

Objective

There exist more than 100 different, standardized procedures for the quality measurement of bitumen. Those, however, can only be performed by qualified personal in a laboratory. In order to ensure a complete quality control of all processes including production, delivery, processing and recycling, a mobile, fast, and reliable, yet easily performed measurement method is needed.

Technology

A promising approach for such a complete quality control, which has already proven successful in many applications and industries, is fluorescent spectroscopy. Different from a purely mechanical measurement method, fluorescent spectroscopy makes it possible to draw conclusions about the bitumen's chemical composition, and thus, also its age condition. The research by Prof. Hinrich Grothe and his team at TU Wien has led to the development of a corresponding hand scanner. This scanner utilizes conventional LEDs to stimulate the bitumen's fluorescence, and a photomultiplier (PMT) to capture the reflexion, as well as software that has been developed specifically for interpreting the measurement results.



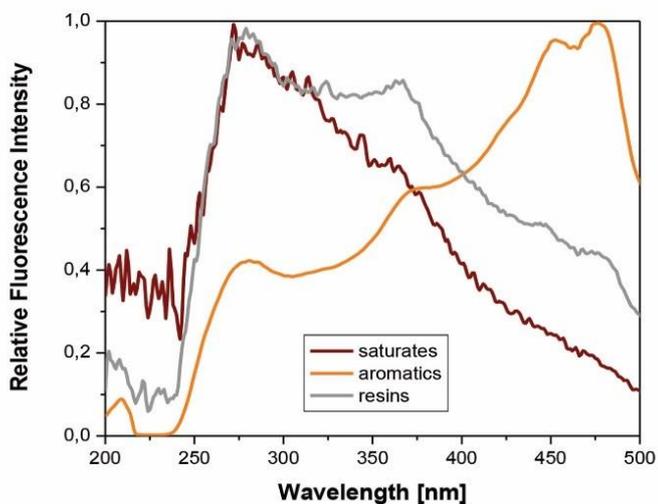
Advantages of the fluorescence scanner

For laboratories, refineries, mixing plants, roads, waterproofing of buildings, and corrosion protection of technical components:

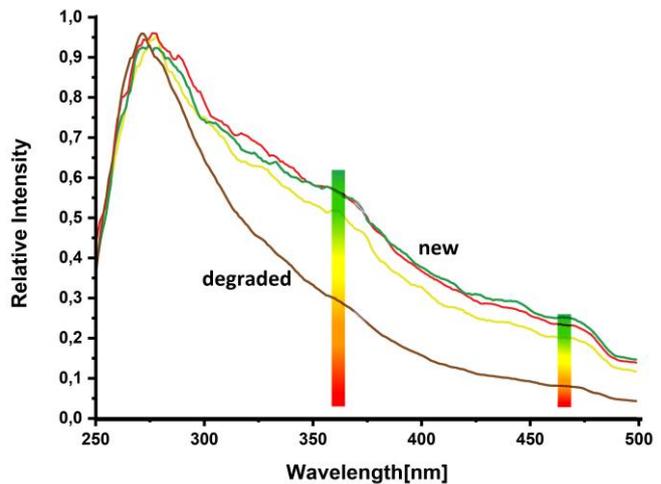
- Short measurement process of just a few seconds
- Convenient handling and flexible application due to compact design
- Robust and mobile scanner ideal for outdoor use
- Easy-to-understand operating principle, no elaborate training needed
- Complete quality control of the entire process chain, including production, delivery, processing and recycling
- Higher prices for suppliers and distributors because of quality guarantee
- Receiving inspection for buyers and processors becomes easy
- Avoidance of unnecessary follow-up costs because of the bitumen's controlled quality

Solution

The research teams around Prof. Hinrich Grothe from the Institute of Materials Chemistry, together with Prof. Bernhard Hofko from the Institute of Transportation at TU Wien have focused their research on the aging of bitumen as well as on the measurement thereof. Due to the aging of bitumen its composition changes, particularly the proportions of alkanes, aromatics, resins, and asphaltenes. A new approach to measure these proportions is fluorescent spectroscopy. A change in the composition of the four fractions changes the fluorescence spectrum within the visible spectral range.



Typical spectral lines of bitumen's essential components



Fluorescence spectra of bitumen of different road surfaces

Fresh and aged samples show significantly different spectra. It was shown that specific excitation wavelengths play a significant role for the quality control, as the intensity of their reflexions correlates directly with the bitumen's aging condition. The stimulation with wavelengths in the blue, the violet, and ultraviolet spectral range is sufficient for capturing the bitumen's quality. It is not necessary to measure a complete spectrum. Based on these findings, a portable and handy scanner was developed, which is able to carry out the measurement in a few seconds. For the first time, a complete quality control of the entire production and recycling chain becomes possible.

Notes

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