Development of a GPC Chromatograms Decomposition Method for Identifying and Quantifying the Degradation of SBS Polymer Modified Bitumen

Lin, Peng

Publication date
2022

Document Version
Final published version

Citation (APA)
Lin, P. (2022). *Development of a GPC Chromatograms Decomposition Method for Identifying and Quantifying the Degradation of SBS Polymer Modified Bitumen*. Abstract from 59th Petersen Asphalt Research Conference, Laramie, Wyoming, United States.

59TH

PETERSEN ASPHALT RESEARCH CONFERENCE

JULY 19 - 21 | LARAMIE, WY

www.petersenasphaltconference.org

Presented by:
Western Research INSTITUTE

Abstracts

Session 4: Asphalt Material Modification – Polymer, Rubber, Reactive Chemistry

Understanding the Principles for Storage Stability in Ground Tire Rubber Modified Binder

Brittany Hallmark-Haak | *Iowa State University*

Ground tire rubber (GTR) is a sustainable, cost-effective addition to binder that improves the resilience of the road as well as its viscoelastic properties. However, GTR has not been widely utilized due to its difference in density with that of binder that causes separation if not continuously stirred. At Iowa State University we have developed a method to stabilize GTR in binder. This method reacts GTR with a polydiene additive using simple mechanical compounding techniques. Preliminary storage stability (ASTM D6930 – 10), softening point (ASTM D 36 – 0), and separation index (measured by G*/sin(δ)) have demonstrated that the modified GTR is stable in the binder. The aim of this research is to further characterize the interaction between the GTR and the polymer in the compounded pellet (such as rheological properties, SEM, and density). Additionally, we utilized Computerized Tomography (CT) scans to visualize and quantify the degree of separation of the GTR particles in the blended and reacted binder samples. This characterization will accelerate, facilitate and increase the understanding of how the GTR and polymer interacts with binder to improve storage stability.

Development of a GPC Chromatograms Decomposition Method for Identifying and Quantifying the Degradation of SBS Polymer Modified Bitumen

Peng Lin | *Delft University of Technology*

SBS polymer modified bitumen (SPMB) can notably improve the performance of asphalt pavement and is widely employed on the surface layer of pavements. However, SBS polymer is sensitive to ageing and its degradation evolution is difficult to be quantitatively characterized due to the overlapping of GPC chromatograms. In this research, a chromatogram decomposition method (CDM) is proposed based on a combination of experimental quantitative analysis and mathematical deconvolution methods, which target simultaneous identification and quantification of degraded SBS polymers in SPMB. According to the experimental and analysis results, the overlapped chromatograph peaks of 24 different SPMB binders (different SBS contents, base bitumen types and ageing levels) were successfully decomposed and the degraded SBS polymer was quantitively analyzed by the CDM method. Meanwhile, the CDM analysis parameters of SPMB binders demonstrated a good correlation with the rheological characterization results, indicating the validity of the proposed CDM method. These results revealed the degradation process of SBS polymer during the aging of SPMB, and also provide a promising analytical strategy for the polymer modified bitumen with overlapped GPC chromatograms.

The Use and Benefits of Isocyanate Modified Asphalts in Emulsions for Pavement Preservation

Arlis Kadrmas | *BASF Corporation*

The use of reactive isocyanates to modify asphalts can provide benefits over traditional modifiers, especially to improve the adhesive nature of the binder. The adhesion improvement can help the performance of the residue of the asphalt emulsions in many pavement preservation techniques.
This presentation will go over the ability of the reactive isocyanate based modified asphalts to make a quality emulsion. This will be shown through the particle size change of the emulsion over time using a variety of formulations. The residual properties will be evaluated using high and low temperature recovery techniques for comparison in traditional testing and DSR. It will be shown that traditional residue testing may not be adequate to quantify performance of new polymer or additives for pavement preservation techniques.
An example of the adhesive improvements of the reactive isocyanate modification will be shown in sweep testing results.