Patent Search

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Abstract:

The present invention provides a standardized method for quantifying the self-healing performance of bitumen binders using controlled strain-induced damage, temperat conditions, and rest periods. A bitumen sample is aged, placed in a Dynamic Shear Rheometer, and subjected to a predetermined strain amplitude to induce defined redu in complex shear modulus (G*). An initial damaged modulus value is recorded, followed by exposure to controlled healing temperatures and rest durations. A post-rest mo value is then measured to compute a healing percentage representing the binder's recovery. The method enables accurate, reproducible comparison of healing performar across viscosity-graded and polymer-modified binders, supporting improved material selection, pavement design, fatigue prediction, and durability assessment.

Complete Specification

to controlled damage and rest cycles. These methods fail to distinguish between reversible viscoelastic recovery and irreversible structural degradation because they do impose defined damage thresholds nor measure modulus restoration with sufficient sensitivity. Consequently, the scientific community lacks a uniform framework for interpreting healing efficiency, rendering inter-laboratory comparisons inconsistent and limiting the ability to specify binder healing properties in pavement design specifications.

[004] The prior art also suffers from the inability to differentiate between the healing potentials of various binder types, particularly with respect to viscosity-graded bind such as VG40 and polymer-modified binders such as PMB40, which behave distinctly under thermal and mechanical stimuli. Polymer modification introduces elastomeri recovery and microstructural rearrangement mechanisms that may enhance healing at elevated temperatures or under extended rest periods. Nonetheless, no existing methodology provides a reliable means to compare these behaviors under identical, controlled levels of induced damage. Traditional fatigue–rest–fatigue methods are ti consuming, lack reproducibility, and provide only qualitative insights. Without a systematic, binder-agnostic approach that precisely defines initial damage and quantifies healing, practitioners cannot accurately assess or compare healing tendencies across different materials.

[005] Furthermore, current testing protocols do not simulate the staged damage–rest cycles that asphalt pavements naturally undergo due to intermittent traffic loading followed by periods of reduced or no loading. The absence of controlled strain-induced degradation that represents specific percentages of modulus loss renders existin evaluations disconnected from realistic field phenomena. Temperature-dependent healing is also inadequately captured by conventional methods, which typically rely o

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