

Enhancing the Storage Stability of SBS-Plastic Waste Modified Bitumen Using Reactive Elastomeric Terpolymer

Abstract

Polymer-modified bitumen (PMB) with a polymer content of up to 6% has a tendency of experiencing phase separation during hot temperature storage. This paper aims to minimize phase separation of a hybrid PMB that combines styrene butadiene styrene (SBS) and recycled linear low-density polyethylene (R-LLDPE). Reactive elastomeric terpolymer (RET) was used as a compatibilizer and its influence on storage stability was analysed via a series of physical, rheological and chemical tests to investigate phase separation. Softening point test shows that the optimum content of RET is 1%, with a higher content (> 1%) resulting in gel formation. RET increases polarity and reactivity, hence it has the capability of chemically cross-linking the polymers and bitumen. The addition of 0.2% polyphosphoric acid (PPA) improves the performance as it acts as a catalyst that facilitates the chemical reaction. The results from the frequency sweep test found that analysing the complex modulus, phase angle and plotting the black diagram is necessary since the phase separation index based on softening point can be a misleading indicator due to gelation. From the infrared spectroscopy analysis, a similar chemical composition between the top and bottom sections generates comparable absorption peaks and intensity. Finally, fluorescence microscopy indicates a continuous phase, hence displaying a homogeneous dispersion of polymers within the bitumen.

Keywords

Asphalt; Compatibilizer; Reactive elastomeric terpolymer; Recycling; Storage stability; Waste plastics