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Thermomechanical Behavior of Asphalt Modified with Thermoplastic Polymer and Nanoclay Dellite 43B

Authors : L. F. Tamele Jr., G. Buonocore, H. F. Muiambo

Abstract : Asphalt binders play an essential role in the performance and properties of asphalt mixtures. The increase in heavy loads, greater traffic volume, and high tire pressure, combined with a substantial variation in daily and seasonal pavement temperatures, are the main responsible for the failure of asphalt pavements. To avoid or mitigate these failures, the present research proposes the use of thermoplastic polymers, HDPE and LLDPE, and nanoclay Dellite 43B for modification of asphalt in order to improve its thermomechanical and rheological properties. The nanocomposites were prepared by the solution intercalation method in a high shear mixer for a mixing time of 2 h, at 180℃ and 5000 rpm. The addition of Dellite 43B improved the physical, rheological, and thermal properties of asphalt, either separated or in the form of polymer/bitumen blends. The results of the physical characterization showed a decrease in penetration and an increase in softening point, thermal susceptibility, viscosity, and stiffness. On the other hand, thermal characterization showed that the nanocomposites have greater stability at higher temperatures by exhibiting greater amounts of residues and improved initial and final decomposition temperatures. Thus, the modification of asphalt by polymers and nanoclays seems to be a suitable solution for road pavement in countries which experiment with high temperatures combined with long heavy rain seasons.

Keywords : asphalt, nanoclay dellite 43B, polymer modified asphalt, thermal and rheological properties
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