

Influence of clay nanoparticles on the physical and rheological characteristics of short term aged asphalt binder

ABSTRACT

This research paper presents laboratory investigation on the physical and rheological properties of asphalt binder modified with Organic Montmorillonite Nanoclay (OMMT). Two different concentrations (1% and 7% by weight of base asphalt) of OMMT was selected to blend with 80/100 penetration grade asphalt binder. The base as well as the OMMT modified asphalt binders was subjected to short term aging process by means of Rolling Thin Film Oven test (RTFO) in order to investigate the influence of the addition of OMMT nano clay in the asphalt binder properties after aging. Bituminous binder properties were investigated by both physical and rheological methods. In general, the physical test results demonstrated prominent increment in softening point; viscosity and decrement in penetration for both concentration of OMMT modified binder as compared to non-modified binder. The results of the experiments indicated that the addition of nano particles was helpful in increasing the complex modulus values and in improving rutting resistance of the RTFO binder. The phase angle of the binders generally decreased with an increase in nano content and RTFO aging procedure. Also, the results indicated that modified binders show better rheological properties compared to standard bitumen. The addition of OMMT to base asphalt binder has led to noticeable improvements in aging resistance this may be due to the homogeneous dispersion of nano particles consisting of layer silicate in the asphalt medium. Thus, nano clay is foreseen as a novel kind of resistance to aging and permanent deformation potential for bitumen.

Keyword: Asphalt; Montmorillonite; Nanoclay; Aging; Physical properties; Rheological properties