The Influence of Colloidal Nanosilica on Microstructure of Asphalt Binder after Long-Term Aging

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ABSTRACT

The use of Atomic Force Microscopy (AFM) to observe the microstructure of asphalt binder promises a better insight compared to other microscopy techniques. In this study, AFM was used to investigate the effect of nanosilica concentration and aging conditions on the microstructure of asphalt binders. Asphalt binder penetration grade of 60/70 was modified with nanosilica (NS) by varying its concentration ranging from 1% to 5% (with the increment of 1%). Nanosilica modified binder (NSMB) were aged using a pressure aging vessel (PAV). The microstructure of the NSMB before and after aging were characterized using tapping mode of the atomic force microscopy (AFM). The effect of nanosilica (NS) addition and PAV ageing on the phase distribution, size of 'bee' structure and surface roughness of the asphalt binder were investigated. Based on this study, it was found that the addition of NS into asphalt binder tended to increase the distribution of the catana phase, as well as increasing the size of the bee structure and surface roughness of the AFM image. Besides that, the after long-term ageing was applied, the number of the bee structure and distribution of catana and peri phase also increased. It can be concluded that the addition of NS and aging increased the overall surface stiffness of the bitumen and has made the material surface more solid-like.

KEYWORDS

Atomic Force Microscopy, Nanosilica, Catana Phase, Pressure Aging Vessel

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