Evaluation of elevated temperature properties of asphalt cement modified with aluminum oxide and calcium carbonate nanoparticles

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Abstract. Higher temperature properties of the asphalt cement have been characterized before and after modification using dynamic shear rheometer (DSR) and viscosity testing. In this study, calcium carbonate nanoparticles (CaCO₃) and aluminum oxide nanoparticles (Al₂O₃) have been added to the base asphalt cement with concentrations of 3, 5 and 7%wt by the weight of the asphalt cement. The increase of CaCO₃ and Al₂O₃ content has significant effect on the properties of asphalt cement. The viscosity of the modified asphalt cement increased up to 90 and 108% respectively compared to the base asphalt cement. In addition, the results showed that both modifiers have great storage stability and compatibility at elevated temperature. The evaluation of the rheological properties of asphalt cements revealed that the stiffness of the modified samples improved with additional increase of the modifier concentration of up to 5%, which indicates better resistance to rutting parameter. The enhancement was up to 388.89% for Al₂O₃ and 74.07% for CaCO₃. As a result, the usage of CaCO₃ and Al₂O₃ nanoparticles can be considered as appropriate alternative materials to modify asphalt cement.