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Mechanism of Asphalt Binder Aging by Ultraviolet Irradiation and Aging Resistance by Adding Carbon Black

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The components of asphalt binders were separately irradiated with ultraviolet (UV) rays to examine the aging mechanism. The results confirmed that saturates are converted to resins and asphaltenes, resulting in oxygen-containing functional groups, *i.e.* carbonyl group. The observation also suggested that aromatics are converted to resins and asphaltenes by a different mechanism from saturates.
Carbon black, which is extensively used as a weatherproofing filler in the field of plastics, prevented UV conversion of saturates to form carbonyl groups. Furthermore, addition of carbon black to asphalt binder reduced the rise in Fraass brittle point caused by UV irradiation because carbon black suppressed the associated chemical deterioration of asphalt binders. Carbon black also increased the failure strain and stress due to the reinforcing effects. Carbon black was effective for both alleviation of chemical deterioration by UV irradiation and improvement of mechanical properties such as anti-cracking. Therefore, addition of carbon black will improve the durability of asphalt materials and asphalt pavements.

Keywords: Asphalt binder, Ultraviolet irradiation, Aging, Carbon black, Carbonyl group

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