International Association of Chinese Infrastructure Professionals

THE 13th IACIP Annual Workshop:
Adaptive Infrastructure under Climate Change

Analysis of rheological behavior and anti-aging properties of SBS modified asphalt incorporating naphthenic oil (NPO) and UV absorbent

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INTRODUCTION

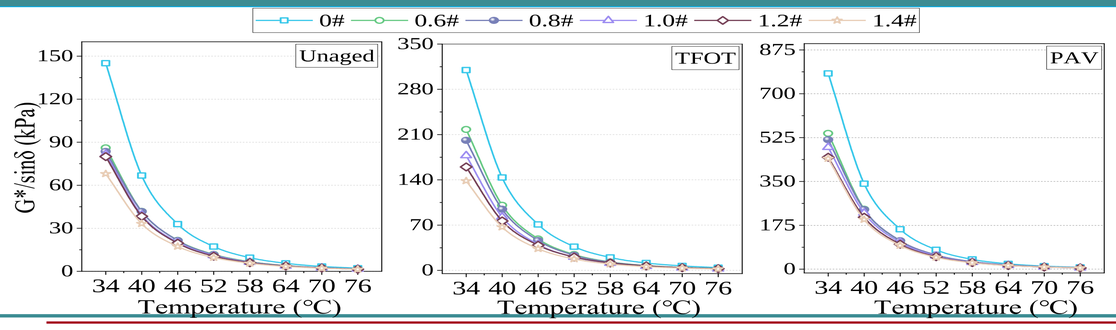
Due to global warming and frequent extreme weather, asphalt pavement is increasingly vulnerable to damage. Especially under the action of high temperatures and strong ultraviolet radiation, asphalt materials are prone to aging. With this is a series of asphalt pavement diseases, resulting in a reduction in driving comfort and safety. SBS modified asphalt is widely used due to its excellent performance, however, the presence of unsaturated C=C makes SBS modified asphalt more prone to aging under external conditions. Therefore, improving the aging resistance and extending the durability of asphalt pavement is an urgent challenge.

OBJECTIVE

- To find a material to improve the resistance of SBS modified asphalt to thermal-oxygen aging.
- To find a material to improve the UV aging resistance of SBS modified asphalt.
- To evaluate the effective of the material in improving the aging resistance of SBS modified asphalt.

MATERIALS AND METHODS

RESULTS AND DISSCUSSIONS



RESULTS AND DISSCUSSIONS

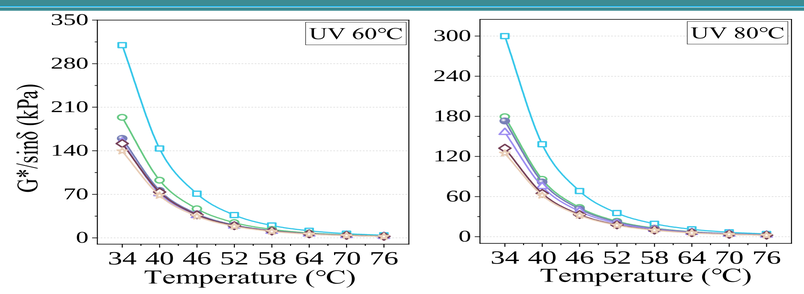


Fig.1. Rutting factor of each asphalt binder.

- The incorporation of composite modifier weakens the rutting resistance of SBS modified asphalt.

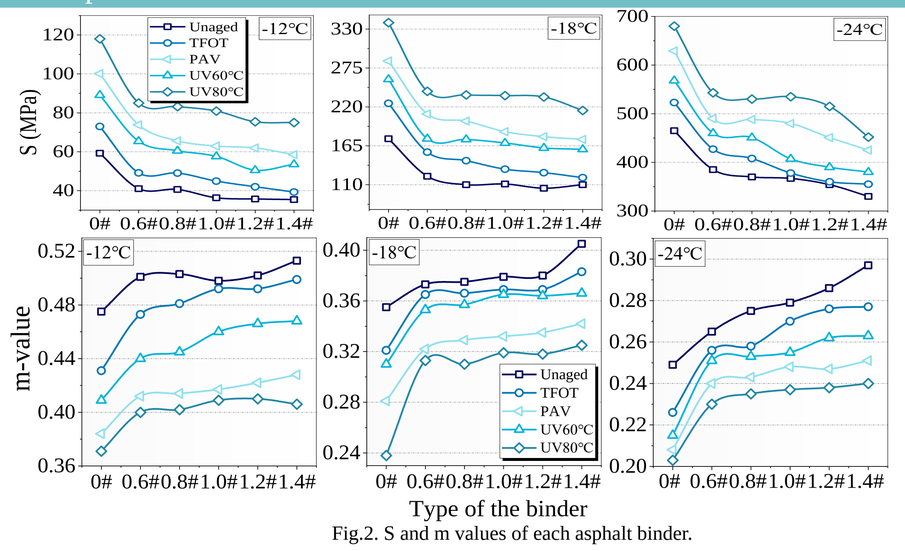


Fig.2. S and m values of each asphalt binder.

- The incorporation of composite modifier enhances the crack resistance of SBS modified asphalt.

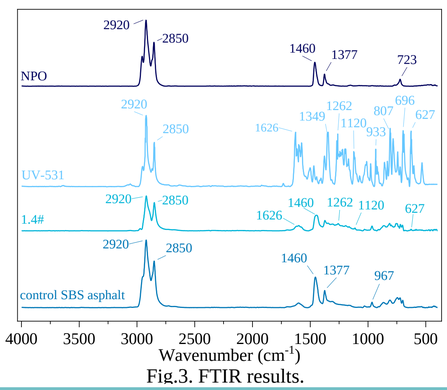


Fig.3. FTIR results.

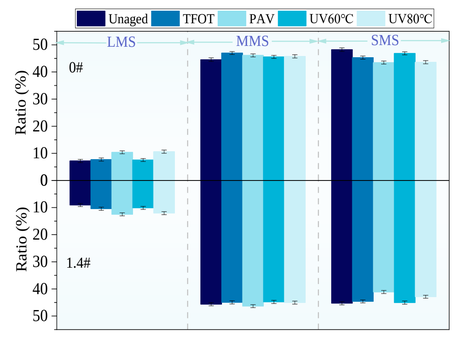


Fig.4. GPC results.

- The NPO/UV-531 composite modifier is physically blended with SBS modified asphalt.
- Compared with control SBS asphalt, the value of SMS for 1.4# asphalt increases by 2.73%, 2.11%, 2.59% and 1.44% after TFOT, PAV, UV 60℃ and UV 80℃ aging, respectively. While the proportion of LMS decreases by 0.69%, 2.34%, 1.83% and 0.72%, respectively.

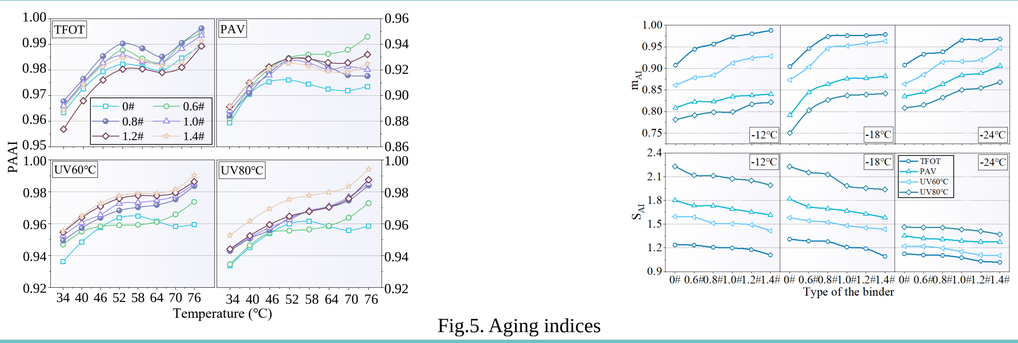


Fig.5. Aging indices

- PAAI（phase angle aging index）for each binder is basically identical, showing an overall upward trend with the increasing temperature.
- The S_{AI} of asphalt binder steadily drops with the composite modifier incorporated, and the m_{AI} gradually increases, regardless of aging degree.

CONCLUSIONS

1. The incorporation of composite weakens the rutting resistance, while remarkably enhanced cracking resistance of SBS modified asphalt.
2. The aging indices results indicated that the aging resistance of SBS modified asphalt is enhanced by incorporating the modifier, and the improvement increased with the addition of content.
3. UV-531 and NPO are physically blended with SBS modified asphalt. The 1.4# asphalt increased SMS value by 1.44%~2.73% and decreased that of the LMS by 0.69%~2.34% compared to control SBS asphalt, proving that the modifier is effective in enhancing creep recovery of aged asphalt at low aging degree.