Pavement Performance of SBS and Rubber Powder Composite Modified Asphalt

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Abstract: Given the research status and shortcomings of modified asphalt in China, we took China National Offshore Oil Corporation 70# asphalt as the matrix asphalt, SBS and rubber powder as modifiers, and used the dosage of 4%, 5% and 6% of SBS as well as 2%, 4%, 6% of rubber powder to prepare composite modified asphalt for contrast test. We also studied the preparation technology for SBS and rubber power composite modified asphalt, analyzed the trend of ductility, penetration, softening point and elastic recovery with different proportions of composite modified asphalt, and then analyzed the reasons causing the trend. The results show that at the certain dosage of SBS, as the amount of rubber powder increased, the ductility showed a decreasing trend while the softening point and elastic recovery showed a rising trend, and the penetration decreased first and then rose. Our study can provide important reference for the preparation technology and performance study of composite modified asphalt.

Keywords: Road engineering; Composite modified asphalt; SBS; Rubber powder; Pavement performance

1. Introduction

SBS (Styrene - Butadiene - Styrene) is a thermoplastic elastic body, which is composed of styrene (hard segment S) and butadiene (soft segment S). SBS mainly uses the linear or star block copolymer obtained by anionic polymerization.[1]The Molecular intermediate is usually made of polybutadiene, which ends of polystyrene. The butadiene is the flexible segment, the styrene segment is the hard part.

SBS and crumb rubber powder have been get further study and a large number of applications as asphalt modifier for pavement. SBS modified asphalt has excellent comprehensive modification effect, but the application scope is limited to highway construction because of its high cost of production.[2].Crumb rubber powder modified asphalt has many advantages such as low production cost, energy conservation and environmental protection, while it exists some performance deficiencies such as high viscosity, poor storage stability and poor scalability in low temperature, so it's difficult to apply it in highway construction[3]. In view of the current research status of modified asphalt, this research adopt the method of SBS and crumb rubber powder compound modified asphalt[4], through the optimization of formulation and preparation process, prepare the SBS/crumb rubber powder compound modified asphalt with low-cost and high performance for pavement.

Through the paper research on SBS/crumb rubber compound modified asphalt in this paper, inspected the effect of a variety of influential factors on property of compound modified asphalt, optimized the formulation and preparation process of SBS/crumb rubber powder compound modified asphalt[5], produced an SBS/crumb rubber powder compound modified asphalt with high-performance and low-cost for pavement, proposed the ideas of improving the comprehensive performance of SBS/crumb rubber powder compound modified asphalt[6] .

2. Study on Pavement Performances

2.1. The Experiment of Pavement Performances

Using different modifier formula of SBS modified asphalt, crumb rubber modified asphalt and SBS / waste rubber powder composite modified asphalt, and carries on the performance test. As a reference to the matrix asphalt, compared to modified effect. Analysis of SBS / waste PS/of crumb rubber modified asphalt modification mechanism. The result of experimental can be used to guiding composite modified asphalt research and production.

The low temperature ductility of asphalt can reflect the deformation ability of asphalt at low temperature. The value of asphalt ductility is greater, the low temperature performance of asphalt is better. All kinds of different formulas ductility results are shown in Figure 1.The ex-

perimental temperature is 5 ℃ and the tensile rate is 5cm/s .

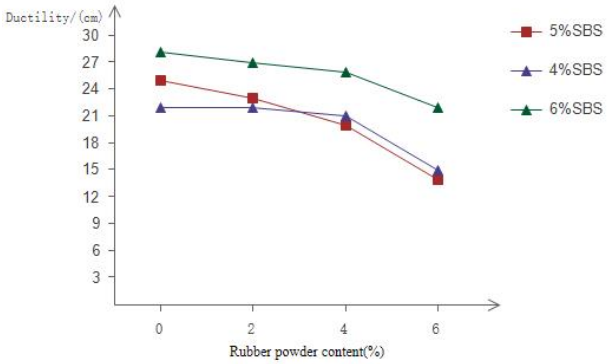

Figure 1. Ductility text result

Penetration can reflect the asphalt degree of hardness and the technical index for 25 ℃ ,100g ,5s experiment standard to test the modified asphalt the penetration. All kinds of different formulas penetration text results are shown in Figure 2.

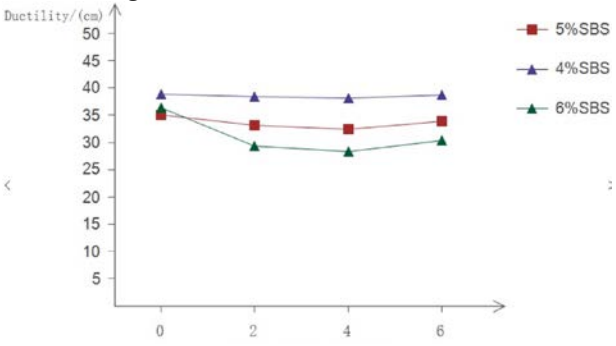

Figure 2. Penetration text result

Softening point can reflect the high temperature performance of asphalt .In this paper, the softening point of modified asphalt was tested by ring-ball method. All kinds of different formulas softening point text results are shown in Figure 3.

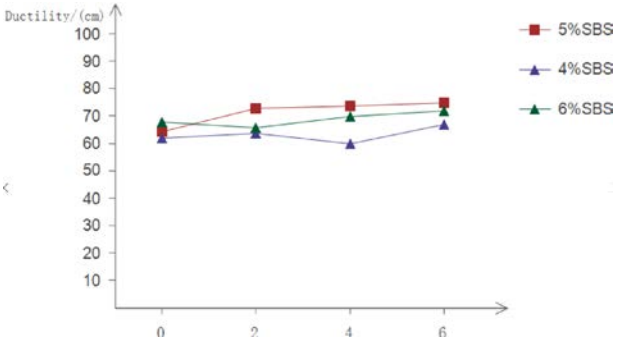

Figure 3. Softening point text result

Elastic recovery rate can be used to evaluate the recoverable deformation capacity of asphalt. The recovery ability of asphalt can reduce the residual deformation under the load, thereby reducing the damage of the road surface. All kinds of different formulas elastic recovery text results are shown in Figure 4.

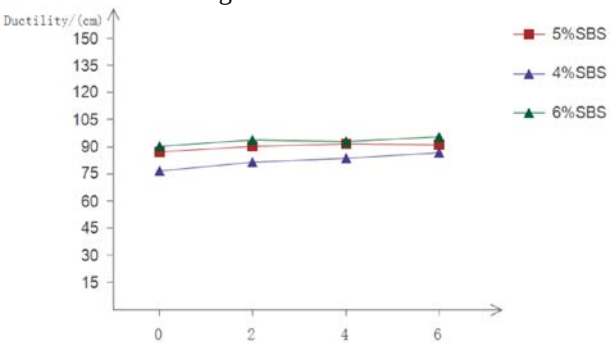

Figure 4. Elastic recovery text result

2.2. Pavement performance analysis

It can be seen from the Figure 1, in a given amount of SBS in the asphalt, with the increase of rubber content, compounding modifier of asphalt extension degree showed a decreasing tendency. When the mixing amount of rubber powder in 0-4%, the reduction of the degree of delay is relatively slow, in the case of greater than 4%, the delay is significantly reduced.

Similarly, It can be seen from Figure 2 that in the SBS asphalt mixed powder, composite modified asphalt the penetration produced changes in different degree, but compared with the matrix asphalt seem hardness higher. When the powder mixing amount is low, the penetration of composite modified asphalt decreases with the increase of rubber powder. However, when the rubber powder content reaches a certain critical value, with the increase of rubber powder content, composite modified asphalt the penetration increases with the increase of rubber powder, indicating that composite modified asphalt gradually changed from a hard soft. This is because some oil in asphalt by rubber powder absorption, swelling after evenly distributed in asphalt, so soft asphalt.

It can be seen from Figure 3 that In the SBS under the condition of a certain dosage, with the increase of rubber content, the softening point of the composite modified asphalt showed a rising trend. As a result of the asphalt and rubber powder structure light group similar after penetration, gradually spread to the rubber network, makes the powder particle swelling, reduce the wax content of asphalt. This will significantly reduce the free wax content of asphalt, making the temperature of the asphalt significantly decreased, the softening point increased significantly. So as to improve the high temperature performance of asphalt.

3. Conclusion

Through the above experimental data analysis shows that: under the conditions of SBS dosage, with the increase of rubber powder content, the ductility of the composite modified asphalt will be decreased of this template. The softening point and elastic recovery will show a rising trend, the penetration value showed a downward trend after the first rise .This reveals the penetration that the relationship between SBS composite rubber modified asphalt ductility, softening point and elastic recovery performance and the modified content .

Through the penetration, ductility, softening point and elastic recovery index, SBS rubber powder composite modified asphalt road with better performance. It is applicable not only to new roads and can be widely used in old cement concrete pavement reconstruction and upgrading renovation project, but also effectively prevent reflection crack generation and propagation.

References

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