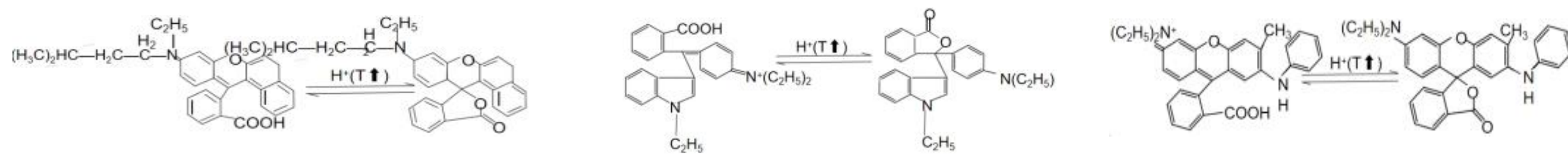
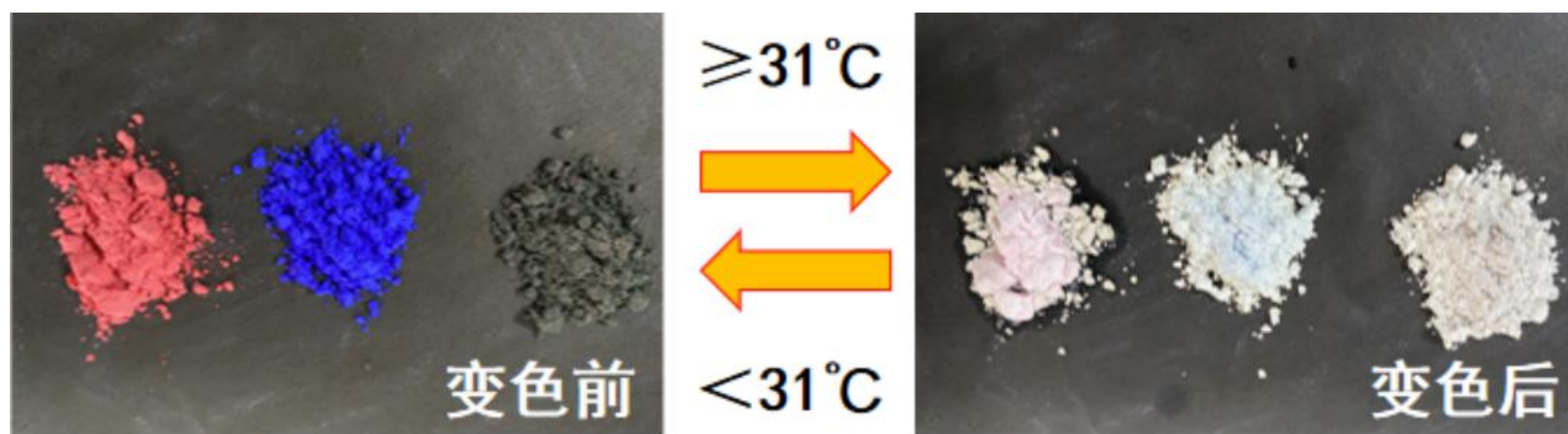


1. Introduction and objective

- To reduce the high-temperature related-distresses of asphalt pavement and prolong the durability performance during the service life
- Thermochromic asphalt mixture** was proposed and investigated in this study
- The road performance and **cooling performance** of the fog-seal with added thermochemic powder were evaluated

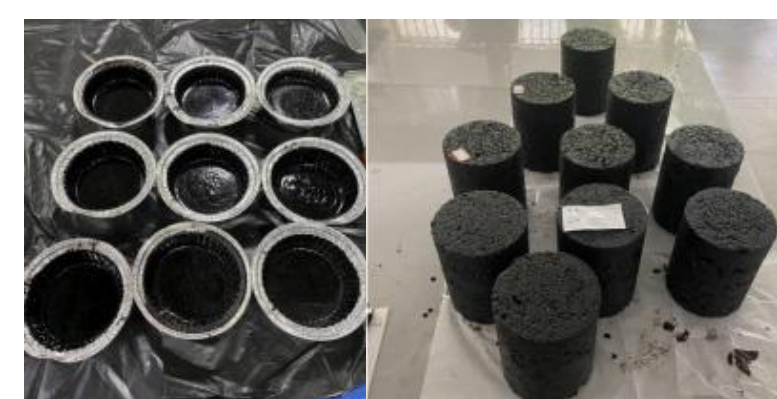
2. Materials selection



- Fast-cracking cationic adhesive oil emulsifier is selected, pH value is 5-7, solid content $\geq 40\%$.
- Anhydrous calcium chloride powdered solid is selected as a stabilizer.
- Polyvinyl alcohol granules are selected as dispersants to reduce the surface tension between thermochromic powder and liquid.
- Thermochromic powder is selected from red, blue and black three color powders, referred to as RTP , BTP , HTP.

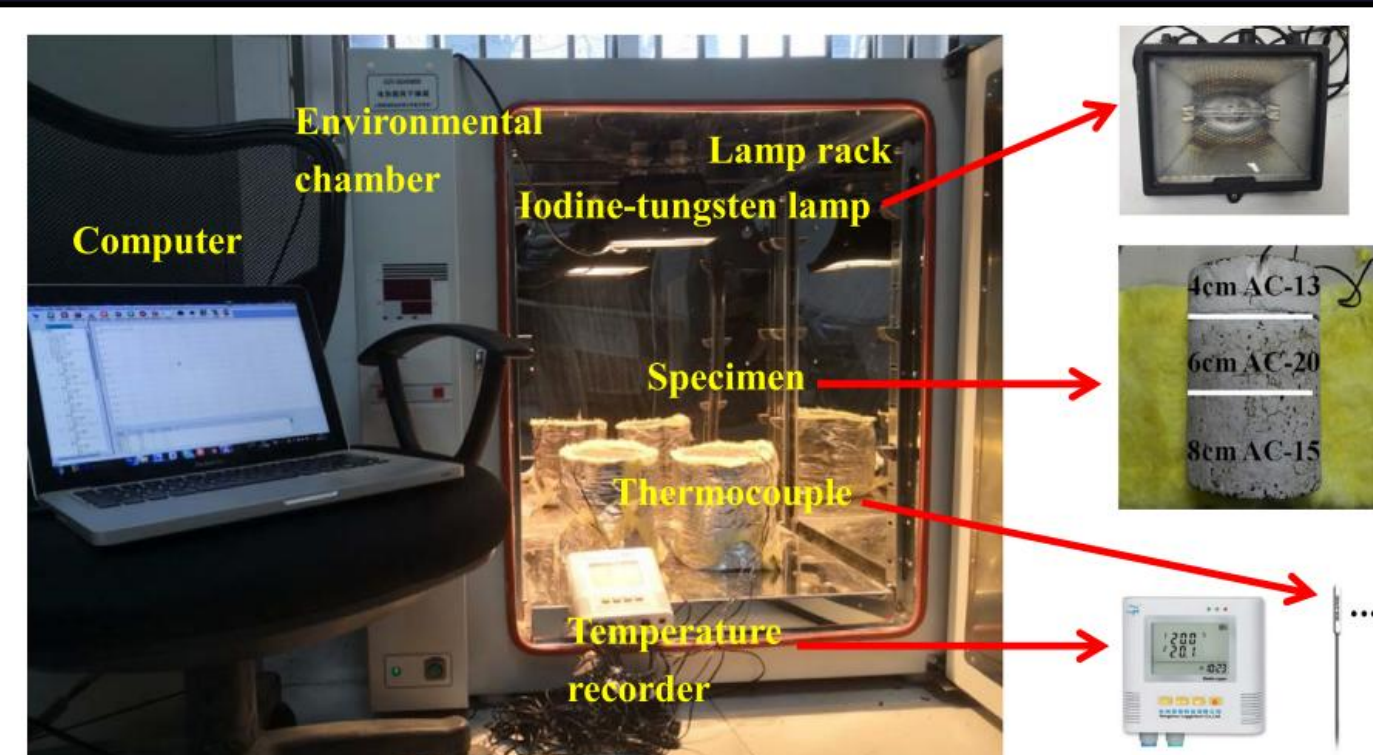
Table 1. Basic properties of thermochromic powders

Powder ID	Discoloration temperature	Water content	Particle size
RTP	31°C	0.1%	1~10μm
BTP	31°C	0.1%	1~10μm
HTP	31°C	0.1%	1~10μm



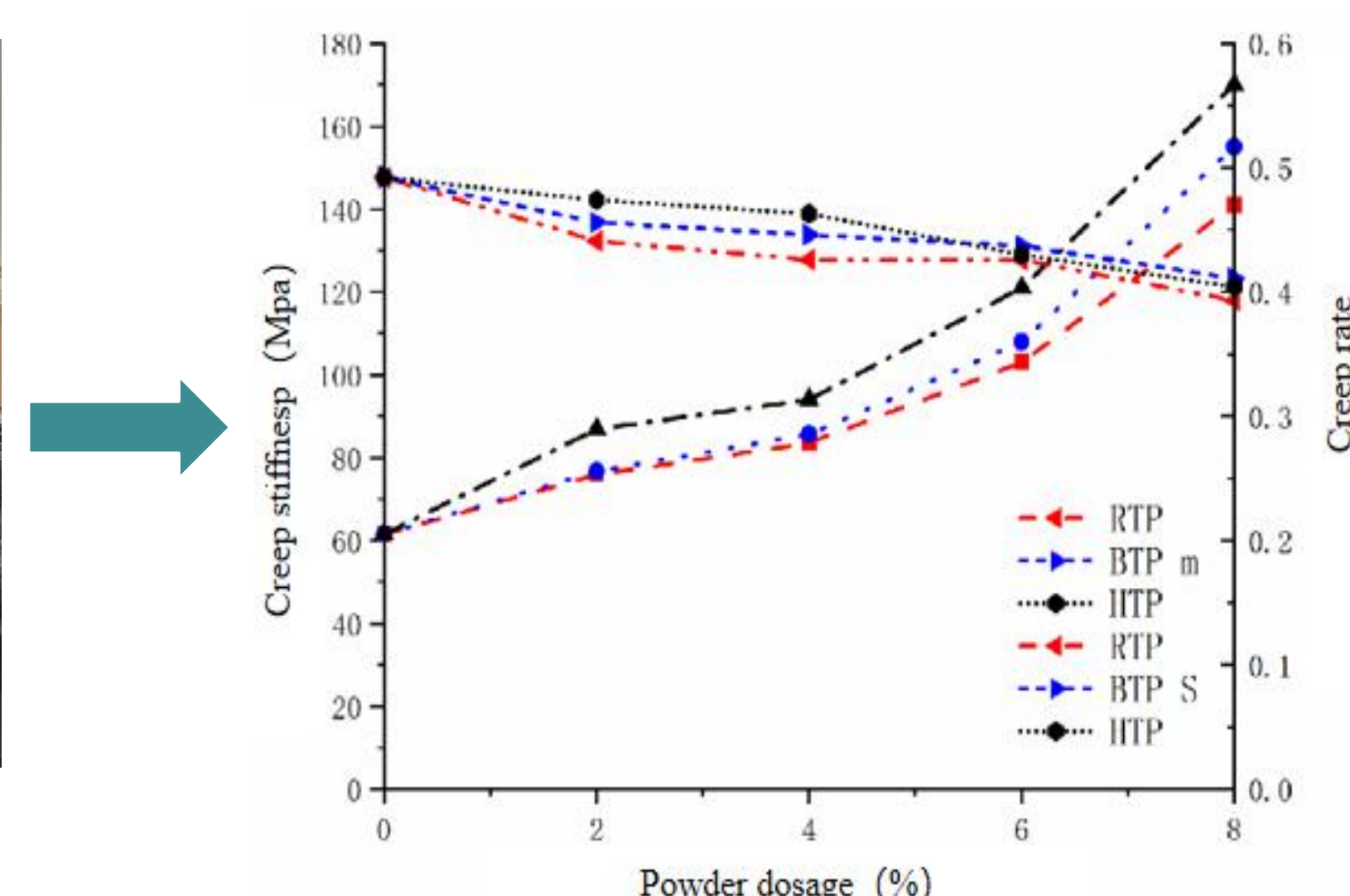
3. Experimental program

- Segregation test
- Low temperature crack resistance test
- Multiple stress recovers creep test
- Sealing road performance test
- Indoor simulated light test
- Outdoor light temperature change test



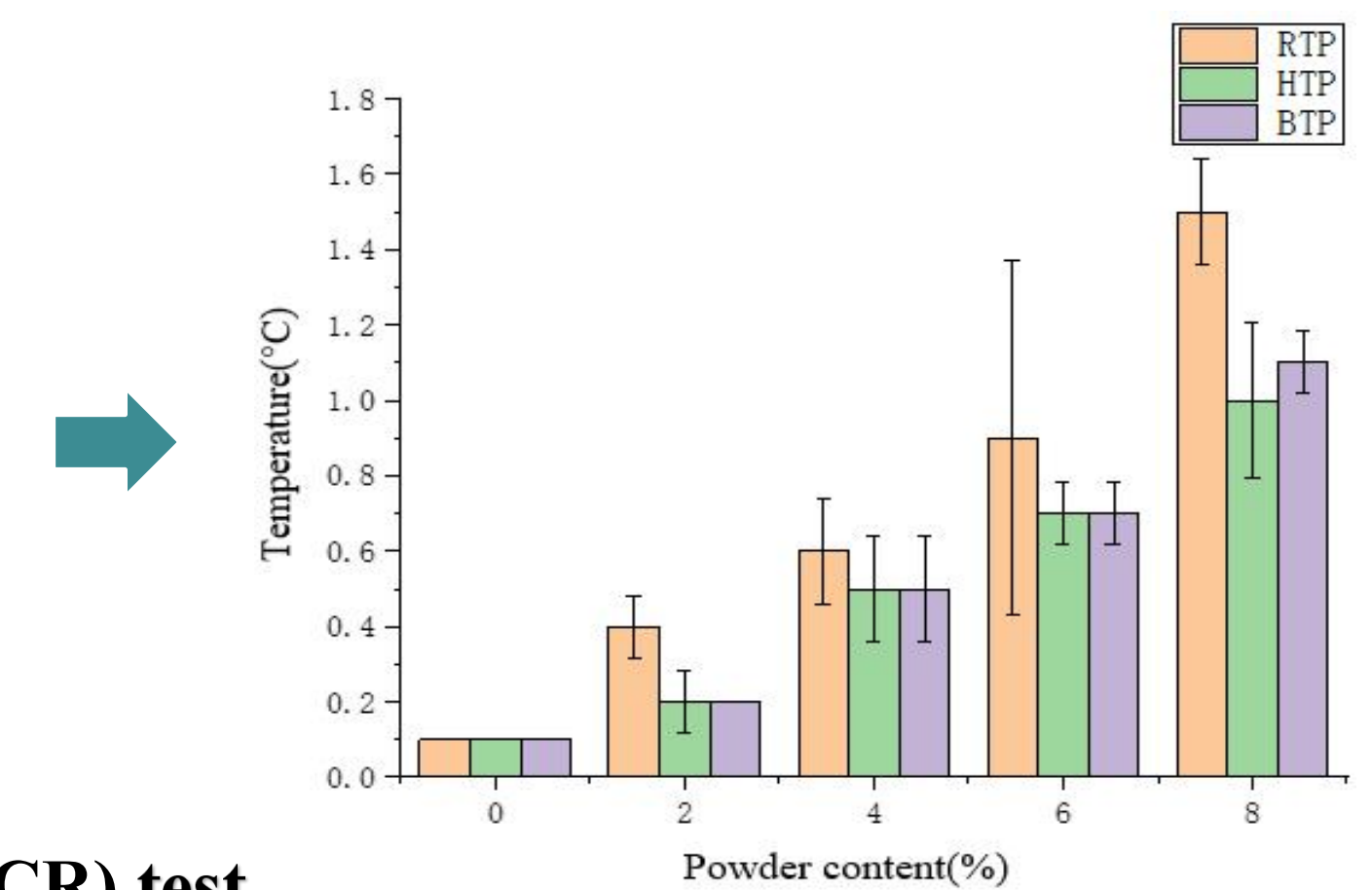
4. Test method and test results

I . Low temperature crack resistance test

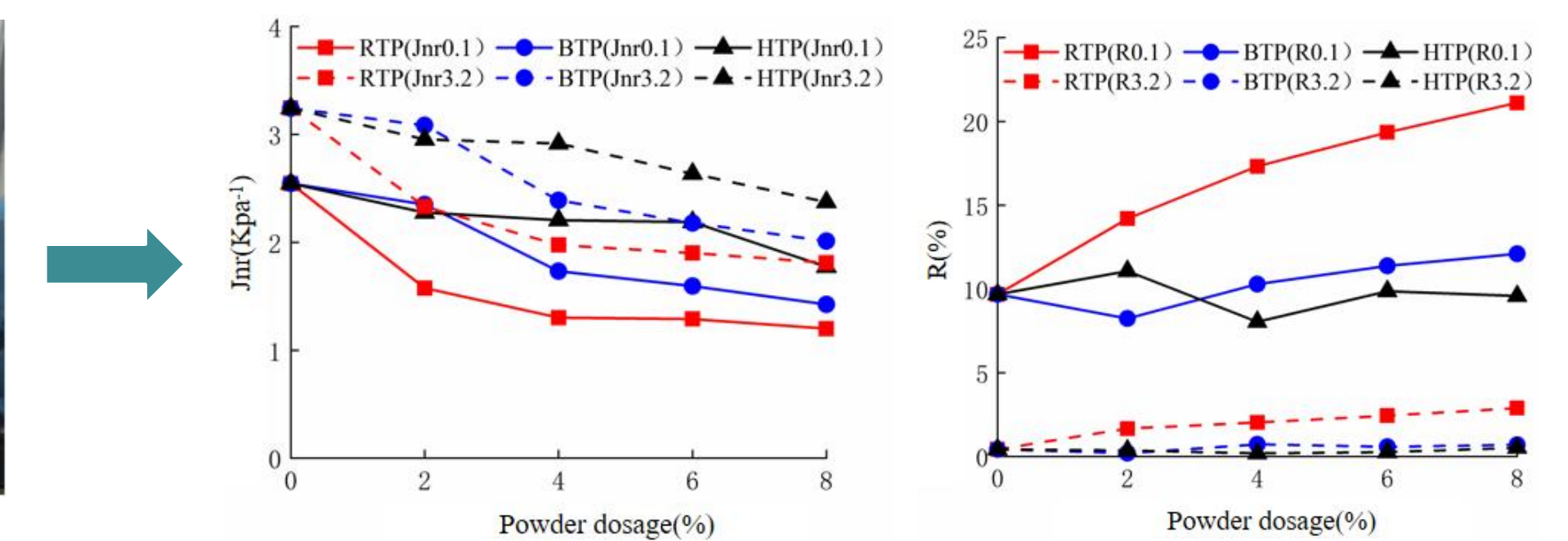
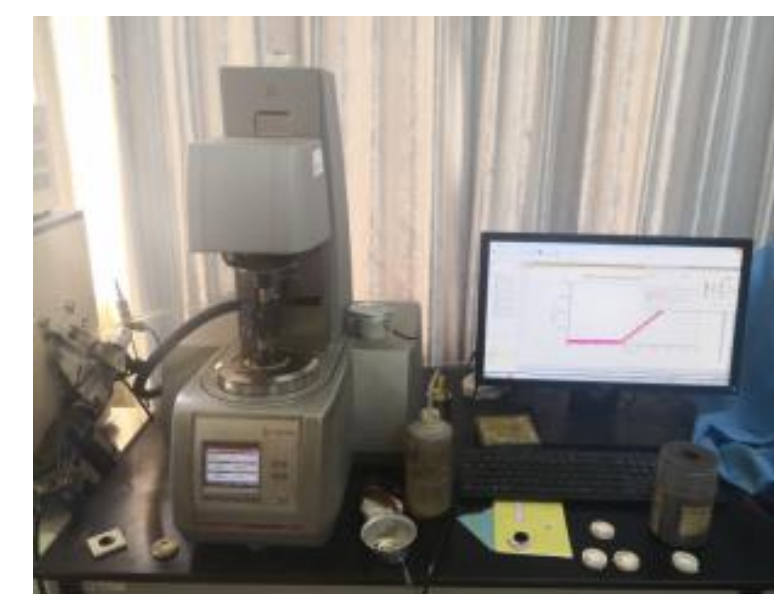


After mixing different colors of thermochromic powder, the creep rate of bitumen shows a downward trend, and the creep stiffness is on the rise, considering the crack resistance of bitumen, **the amount of thermochromic powder should not be too large.**

II. Segregation resistance test



III. Multi-stress creep recovery (MSCR) test



- Thermochromic powders can **reduce the plastic deformation resistance** of evaporation residues, improve the sensitivity of non-recoverable creep flexibility of evaporation residues to heavy loads, and improve high temperature performance.

IV. Road performance test on sealed pavements



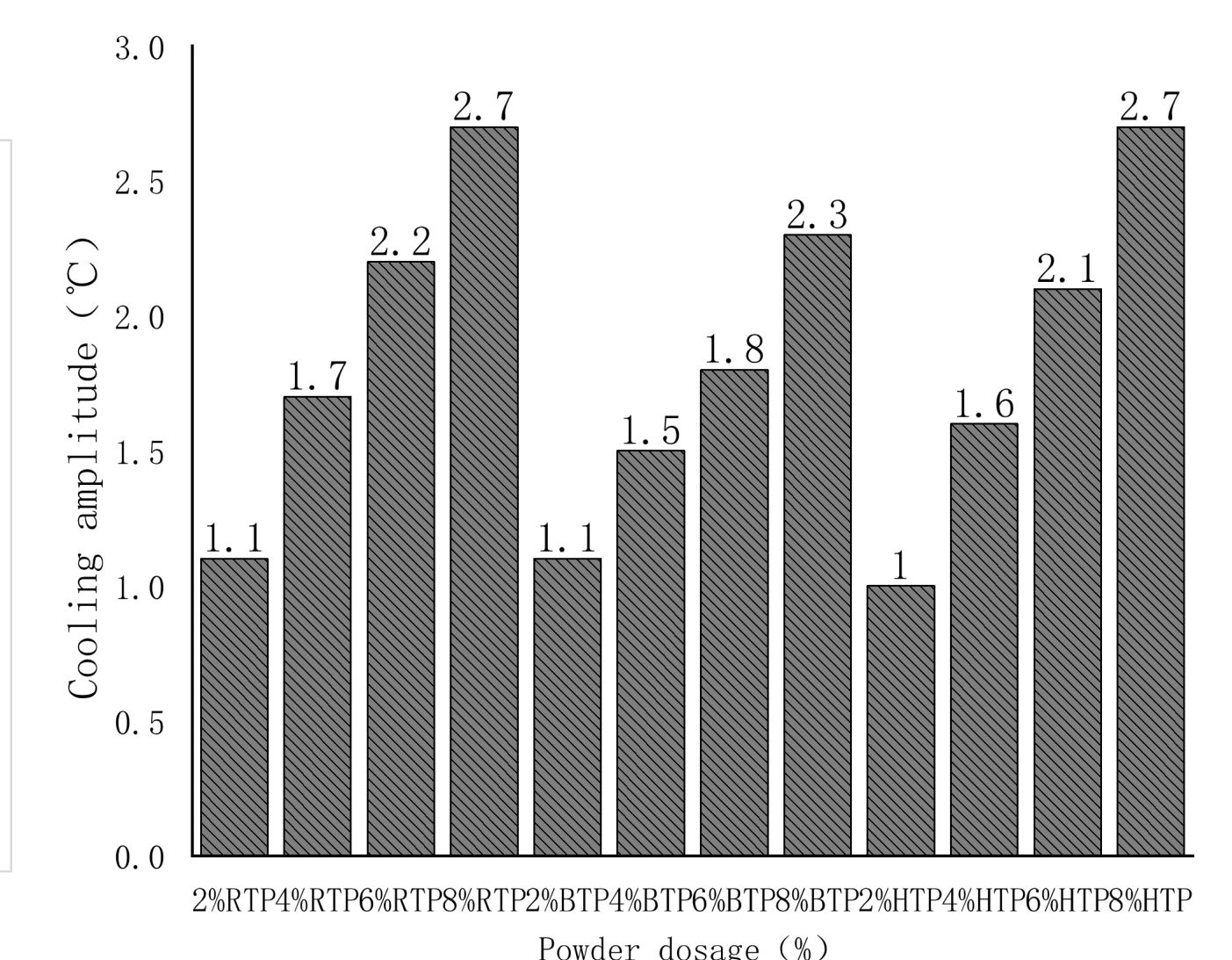
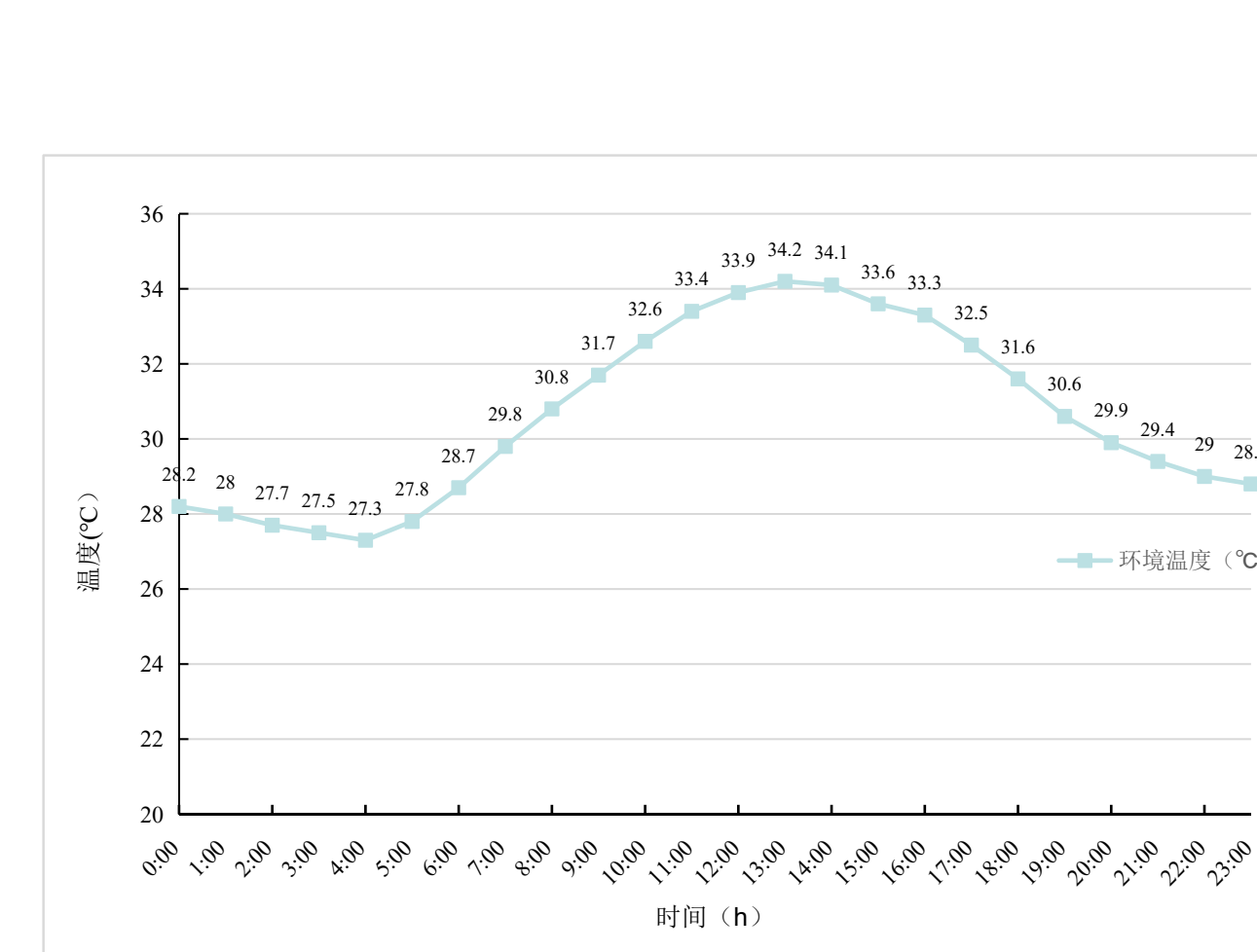
The addition of powder **does not reduce the road performance** of fog sealing layer.

VI. Indoor simulated light test

Type of powder	0%powder	8%RTP	8%BTP	8%HTP
Depth				
surface	70.5	67.3	67.0	67.4
2cm depth	66.5	63.5	63.6	62.9
4cm depth	56.1	53.6	54.0	54.4
6cm depth	52.3	50.3	50.7	51.0
8cm depth	48.2	47.5	46.9	46.9

The indoor light experiment showed that the **cooling was most obvious at a depth of 2 cm, up to 3.6°C.**

V. Outdoor light temperature change test



- Outdoor light experiments show that **the cooling can reach up to 2.7°C at a depth of 2cm in the specimen.**

5. Conclusions

- After 15 days of illumination, the cooling effect of the thermochromic sand-containing mist sealing layer did not decrease significantly.
- Thermochromic powders improve the high-temperature performance of bitumen emulsion.
- The cooling effect of thermochromic sand-containing mist sealing layer on the specimen is most obvious at a depth of 2cm.