Flash Point by Pensky - Martens Closed Tester

Lab Experiment #4

Submitted to:

Matthew Church

CE 361: Highways Materials Laboratory

Prepared by:

Christopher M. Smemoe
Thursday, 8:00 AM

Brigham Young University
Provo, UT 84602

May 12, 1994

Table of Contents

II. Results

The findings of this lab included the following results:

Table 2.1: Flash points of materials A and B

	Flash Point (degrees F)	Predicted Flash Point* (degrees F)
Sample A	135	150
Sample B	125	150

*Obtained From ***Traffic and Highway Engineering***, p. 741

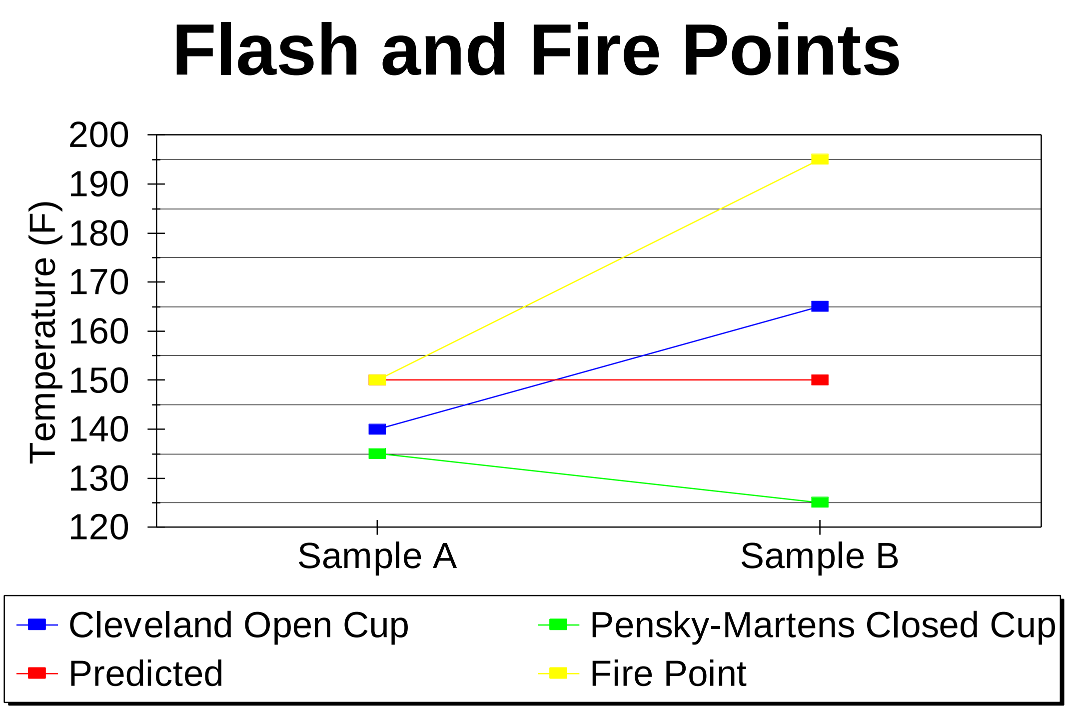

Figure 2.1: The Flash and fire points of materials A and B in the Pensky-Martens and the Cleveland flash point tests.

III. Discussion

Procedure

After thoroughly cleaning the testing apparatus and cup, the test cup was filled to the level indicated by the filling mark. With the heating device set to the proper level, the thermometer inserted in the testing apparatus, and the stirring device attached, the test was begun at about 70 F. Beginning with material "A", the specimen was heated at a rate of 9-11 F per minute. When testing material "A", the rate of temperature increase was carefully controlled so the flash point could be accurately measured.

After the test flame was lighted, it was applied to the specimen at 4-5 second intervals after the temperature had reached 90 F. The specimen continued to be heated, and the flash point was then observed at a temperature of 135 F.

Sample "B" was then tested using the same procedures as for sample "A", making sure to thoroughly clean the test cup and testing equipment before testing. Sample "B" was heated somewhat more rapidly than was material "A", which may have contributed to an inaccurate flash point reading. The flash point for sample "B" was measured at 125 F.

Answers to "Observations and Discussion"

1. Does the Barometric Pressure at the time of a test affect the flash point?

Yes, the barometric pressure would have an effect on the flash point of an asphaltic material. In the Cleveland Open Cup test, however, the barometric pressure would have a more significant effect. In any flash point test the volatile, flammable gases emitted from the asphaltic material will increase as pressure increases and decrease as pressure decreases. However, since the Pensky-Martens test involves more of a closed system, the effects of atmospheric pressure variations will be less in this test.

2. Could the Pensky-Martens Closed Tester be employed for the detection of contamination of lubricating oils by minor amounts of volatile materials? Explain.

Yes. As was observed in the Pensky-Martens test of sample "B", there could be a large variation in the flash points between the Pensky-Martens and the Cleveland Open Cup tests. This variation may have been caused by inaccurate results, but it may also have been caused by small but significant traces of volatile materials. These volatile materials may have evaporated at a low temperature, creating a flash above the test specimen. Similarly, volatile materials can be detected in lubricating oils by applying a test flame and observing any flash at a temperature well below the flash point of the oil.

Uses of the test

The Pensky-Martens test is used to determine the flash points of liquids, fuel oils, and other lubricating oils. It is especially useful in determining flash points of bituminous materials in closed containers which may contain small concentrations of lower flash point substances. These substances may go undetected in a Cleveland Open Cup test.

Advantages/Disadvantages

The Pensky-Martens test provides a method of accurately measuring the flash point of an asphaltic material in a closed system. If performed correctly, the Pensky-Martens test is a fast and accurate test. But, it is often hard to apply the test flame, trying to keep it lit. In addition, it is hard to determine the actual flash point of a material using the Pensky-Martens test because small flashes from vapor build-up initially occur when testing the material.

Possible Errors

1. When heating material "B", the heating apparatus was set at an improper rate of temperature increase. This caused uneven heating of the specimen (about 20 F per minute instead of the specified 9 - 11 F per minute). This rapid rate of heating may have been the cause of the 125 F flash point temperature for material "B" (compared with the 165 flash point for material "B" in the Cleveland Open Cup test). But the 125 F flash point temperature for material "B" may have also been caused by concentrations of lower flash point substances which were not discovered in the Cleveland Open Cup test due to the lack of a closed container.

2. The flash points observed for both materials may have represented concentrations of substances with a lower flash point than the asphaltic material itself. These flash point temperatures are significant, however, because they represent conservative estimates of the flash point

Limitations of this Lab

In hardened asphaltic materials, it may be difficult to obtain a specific flash point due to volatile substances existing within this material.

V. Conclusions

Properties of the paving material

From the Pensky-Martens test, it has been determined that asphaltic material "A" has a flash point of 135 F while asphaltic material "B" has a flash point of 125 F. These are relatively low flash points, and these temperatures indicate that the asphaltic materials are relatively volatile, being composed of a Medium cured material.

Engineering Significance of this lab

When using materials "A" and "B" in the construction of a highway, temperatures of 125-135 F could easily be reached in hot summer weather. If exposed to a spark or fire, these materials could combust and a small fire could start.

In addition, this test is a measure of the relative volatility of the material and hence its rate of curing.

V. Appendix

Information for this test was obtained from the following source:

Garber, Nicholas J. and Lester A. Hoel. ***Traffic and Highway Engineering***. West Publishing Company, 1988.