New flash point tester

This scientific instrument determines the flash point of a sample in a more efficient and safer manner.

FLASH POINT IS ONE OF THE BASIC TEST PARAMETERS used to characterize basestocks and lubricants. It is a measurement of the flammability of a substance.

Flash point is defined as the minimum temperature where a sufficient amount of a liquid is vaporized to ignite in air. Originally, this test was used specifically to show that kerosene was a fire hazard. Currently, flash points are required to be listed on the safety data sheets for all substances sold commercially.

There are several methods used to determine the flash point of a substance. ASTM D92 measures the flash point by use of the open cup procedure. A sample of the substance being tested is placed in a brass cup that rests on a metal plate. The substance is slowly heated up while the operator slowly passes a small gas igniting torch above the cup to assess the flammability of the air-vapor mixture.

For highly volatile substances such as solvents, the flash point is determined through a closed cup procedure using ASTM D56 (Tag Closed Tester) or ASTM D93 (Pensky-Martens Closed Tester). A small test flame is introduced through one of the openings in the lid into the vapor space above the substance. The flash point is reached at the temperature when a distinct flash is seen in the interior of the cup.

All of these methods suffer from safety drawbacks. Dr. Oliver Sauer, marketing and sales director for Grabner Instruments Messtechnik GmbH (a part of AMETEK Oil & Gas BU) in Vienna, Austria, says, "Classical methods still require a large amount of flammable samples, usually between 70 and 75 mls. More important, an open flame is produced during flash point tests that can pose a high risk, especially for refinery laboratories. For example, an operator testing jet fuel with a flash point of about 50 C but actually running naphtha that has a flash point of -20 C risks an explosion. Commonly, such incidents happen when samples are contaminated with highly volatile components such as the presence of gasoline in diesel fuel."

One other concern with current flash point procedures is environmental issues. Sauer says, "Hazardous fumes and odors can escape from flash point testers, which pose a risk to the health of laboratory personnel. Even closed-cup analyzers are not closed all the time. For example, when coal tar pitch is tested, the samples turn liquid at a certain temperature and produce carcinogenous fumes. Even under a hood, there is no guarantee that all of those fumes are being eliminated before they spread."

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There is need for a new approach to do flash point testing that overcomes some of the detrimental aspects of the current procedures. Such an approach is now available.

KEY CONCEPTS

- Conventional methods for determining the flash point of a substance suffer from safety drawbacks and environmental issues.
- A tester has been developed that determines the flash point in a closed system through a change in pressure.
- This new tester runs the procedure in a much safer fashion, for a shorter period of time and generates a minimal amount of waste.

INSTANTANEOUS PRESSURE INCREASE

A new flash point tester known as the MINIFLASH TOUCH has been developed by Grabner Instruments that determines the flash point of a sample in a more efficient and safer manner. Sauer says, "A small amount of a sample is transferred into a special cup that has an opening into the instrument. A lift elevates the cup inside the instrument to the surface of a heat device, which

forms a closed combustion chamber. Electrodes at the top of the chamber then impose an electric ignition of low, controlled energy. Vapors in the chamber are produced by gradually heating the sample and introducing a definable amount of air though a little bore from the top. When the vapors are catching fire through the electric ignition, they are producing pressure. This escapes through the same bore and a pressure sensor indicates that the flash has happened. A temperature probe reaching into the sample reports the temperature at which this flash occurred."

The flash point is determined by an instantaneous pressure increase detected inside the closed test chamber. This flash point tester follows the procedures in ASTM D6450 (requires 1 ml of sample) and ASTM D7094 (requires 2 mls of sample). ASTM has indicated that the ASTM D7094 procedure is equivalent to the Pensky-Martens closed-cup technique. An image of the tester is shown in Figure 3.

Once the flash point has been determined, the instrument moves into a cool-down mode to enable safe disposal of the sample and minimize exposure to fumes. Sauer explains, "Once the flash point is reached, the instrument immediately brings the temperature down before the sample cup is lowered again. Fumes remain contained in the test chamber and when opened remnants are transported away through fans."

The flash point is determined by an instantaneous pressure increase detected inside the closed test chamber.

There are a number of advantages in using this new flash point instrument. Sauer says, "The actual hands-on time for this procedure is typically no more than 1.5 minutes per sample compared to 13 minutes continuous attendance required for the Pensky-Martens unit. This is a much safer procedure because no open flame is needed and the amount of waste produced is minimal. The sample cup can be cleaned with a tissue."

In using the enclosed unit, a fume hood is not required and the instrument is portable. The repeatability and reproducibility of the unit are dependent on the test method. Sauer says, "According to the round-robin performed for ASTM D6450, the repeatability is 1.9 C and the reproducibility is 3.1 C. For ASTM D7094, the repeatability is 4.1 C and the reproducibility is 5.5 C. The repeatability and reproducibility for the Pensky-Martens tester for the same sample set were 4.1 C and 6.9 C, respectively."

Figure 3 | **Flash points can now be determined in a more efficient and safer manner by using the tester shown.** *(Courtesy of Grabner Instruments Messtechnik GmbH)*

Flash point values covering the 0 C-400 C range can be determined by the instrument. A low temperature version can be used for solvents covering the -25 C-100 C range.

One other feature of this instrument is the ability to use combustion analysis to detect contaminants in a sample. Sauer says, "Flash point detection is based on a measurement of the instantaneous pressure increase. Even very small flames can be detected at a scan measurement. A pressure curve, consisting of the pressure detected after every single ignition, is graphically shown and can be used to detect more than one pressure increase or peak in a contaminated sample."

This instrument has been used to determine the flash points of numerous substances. Sauer does not know of any substance that is incompatible with this flash point tester. He adds, "We would not recommend that caustic or strong inorganic acids be evaluated because they may attack the materials used in the manufacture of the flash point tester."

Additional information can be found at **www.grabner-instruments.com** or by contacting Oliver Sauer at **info.grabner-instruments@ametek.at.** TLT

Neil Canter heads his own consulting company, Chemical Solutions, in Willow Grove, Pa. Ideas for Tech Beat can be submitted to him at ***neilcanter@comcast.net.***