Flash point: A comparison of PureTemp and paraffin PCMs

Flash point plays an important role in the safe handling of chemicals. Although PureTemp and paraffin PCMs have similar melting points, the higher molecular weight of PureTemp compounds makes them less volatile, thereby requiring a significantly higher temperature to generate an ignitable organic vapor and air mixture.

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All liquids have an associated vapor pressure. As a liquid's temperature increases, so does its vapor pressure, thereby increasing the concentration of the vapor in the air. The temperature at which enough vapor is present to generate a mixture with air that can be ignited by an ignition source is the flash point for that liquid. There are two primary methods for measuring the flash point of a liquid: open cup and closed cup. In the open cup method, the liquid is warmed in an open cup and a flame is introduced above the surface of the liquid at an interval until it is ignited. The closed cup method has two variations: a non-equilibrium tester (vapor and liquid are not at a temperature equilibrium) and an equilibrium tester (vapor and liquid are at a temperature equilibrium). In each case, the liquid is heated in a sealed cup and a flame is introduced into the cup through the lid. A non-equilibrium tester for the closed cup method is used to determine the flash point of PureTemp PCMs.

Materials with higher flash points are considered to be less flammable and/or hazardous than ones with lower flash points. The Global Harmonized System (GHS) uses the flash point to assign all flammable chemicals to a given category. The categories are listed in Table 1.

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GHS flammability categories	Criteria
1	Flash point <23°C and initial boiling point ≤ 35°C
2	Flash point <23°C and initial boiling point > 35°C
3	Flash point ≥ 23°C and ≤ 60°C
4	Flash point > 60°C and ≤ 93°C

Table 1. The relationship between flash point, boiling point and the GHS flammability category

While some of the more common organic solvents are extreme fire hazards due to their low flash point temperatures, PureTemp PCMs, which are also organic compounds, are not. The higher molecular weight of these compounds makes them less volatile, thereby requiring a significantly higher temperature to generate an ignitable organic vapor and air mixture.

Table 2 shows the flash points of various PureTemp PCMs and the flash points of corresponding paraffins with similar melting points. The measurements were performed by Entropy Solutions following the ASTM D93 standard. In each case the PureTemp PCM has a higher flash point temperature than the paraffin with a similar melting point. Since the flash point for each PureTemp PCM listed below is above 93°C, they are not included in any of the four GHS categories and are not considered to be flammable. The majority of other PureTemp PCMs also have flash points above 93°C.

Melt point	Paraffin	Flash point	PureTemp	Flash point
6 °C	Tetradecane	108 °C	PT 6	190 °C
18 °C	Hexadecane	126 °C	PT 18	132 °C
28 °C	Octadecane	158 °C	PT 28	192 °C
37 °C	Eicosane	170 °C	PT 37	186 °C

Table 2. A comparison of the flash points of paraffin and PureTemp PCMs

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Based on the data provided above, it should be clear that these PureTemp PCMs are considered to be a low flammability hazard. Also, since the flash points of these PCMs are so much higher than the desired phase change temperature and presumably the operating temperature for a given application, the flammability concern can be reduced even further.

About the author

Dr. Aymara Albury joined Entropy Solutions in 2013 after earning her Ph.D. in synthetic organic chemistry from the University of Alabama. She earned a Bachelor of Science degree in chemistry at Alabama in 2007. She published three papers during graduate school:

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