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What is dewpoint?

Dewpoint temperature T_d [°C or °F]

Dewpoint temperature (°C or °F). Dewpoint is the temperature where condensation begins, or where the relative humidity would be 100% if the air was cooled. This is readily apparent from the diagram for water vapor, given that dewpoint is just a more intelligible way to express partial water vapor pressure (see Figure 2: Dewpoint of gas at 42% RH).

Even though dewpoint is expressed as a temperature, it correlates with the amount of water vapor in the air, and is therefore not dependent on ambient temperature. Dewpoint temperature is always less than or equal to the actual temperature, with the extremes for normal outdoor air being –30 °C and +30 °C. Dryer and wetter gases can be found in industrial environments, for example, where dewpoints between –100 °C and +100 °C are sometimes measured. Theoretically, the dewpoint temperature can be as low as –273 °C (absolute zero), but at a normal atmospheric pressure it can never exceed 100 °C. When the dewpoint is 100 °C, the air only contains water vapor and no other gas, so the amount of water cannot be raised without increasing the density of the vapor, and hence the pressure.

The water vapor saturation pressure at different temperatures is a known variable, so the dewpoint can be calculated from the relative humidity and temperature. Conversely, if the dewpoint and temperature or relative humidity are known, the missing variable can be calculated.

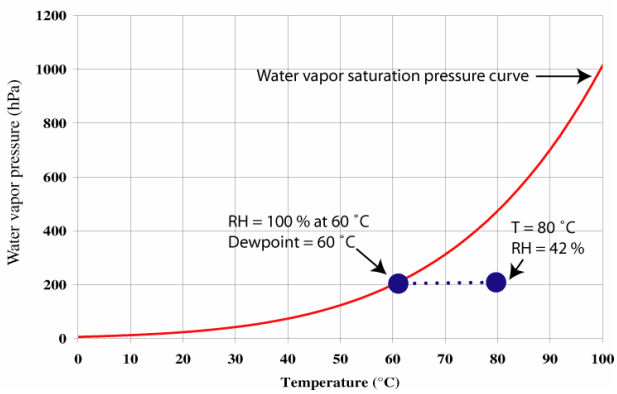
A glass of beer or any cold drink provides a practical example of dewpoint. Since the glass conducts heat fairly well compared to air, it cools to almost the same temperature as the drink. The air surrounding the glass is then cooled, creating a thin layer of air at nearly the same temperature as the glass. If the temperature of the drink is below the dewpoint temperature of the surrounding air, the air around the glass will become saturated with water and the excess water will condense on the surface of the glass. These small water droplets are called dew.

If the temperature of the drink is above the dewpoint temperature of air, the relative humidity of the air surrounding the glass will be higher than the ambient humidity, but no visible condensation will occur.

Frostpoint T_f [°C or °F]

If the dewpoint temperature is below the freezing point, the term frostpoint is sometimes used. The water vapor saturation pressure of ice is slightly lower than that of water, which must be taken into account when calculating frostpoint. When frost actually forms on a surface, it always occurs at the frostpoint, and not at the dewpoint temperature.

Figure 2. Dewpoint of gas at 80 °C and 42% RH.



Measurement technology

The three most common methods to measure dewpoint are chilled mirror, metal oxide and polymer sensor.

Chilled mirror

This technology can offer the highest accuracy over a wide range of dewpoint. However, due to its optical measurement principle, it is very sensitive to dirt or dust on the sensor. Accurate chilled mirror devices are expencive and therefore mostly used where the absolute accuracy is needed and frequent maintenance can be done, e.g. in laboratories.

Metal oxide

This including alumium oxide tehnology, is designed for low dewpoint measurement in industrial

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processes. It offers measurement down to low dewpoint, but its weakness is low long-term stability. The drift in the output reading means frequent calibration which cn typically be done only at the manufacturer's calibration site. Metal oxide sensor designed for low dewpoints can also be destroyed if wetted or exprosed to high humidity.

Polymer sensor

This is immune to condensed water and therefore have a wide humidity range including condensing environments. Polymer sensors have been used for decades in a wide variety of application e.g. in industry and meteorology. A modern polymer sensor with in-built calibration capability can be very used for applications with low dewpoits. The main advantage of the technology is the long-term stability. Polymer technology combined with intelligent electronics can offer a high-performance solution for applications where a dewpoint transmitter with less maintenance is needed.