TMCAqua – Clean Water Recovery

TMCAqua recovers hot water from hot, humid gas streams that are above their dewpoint.

By definition:

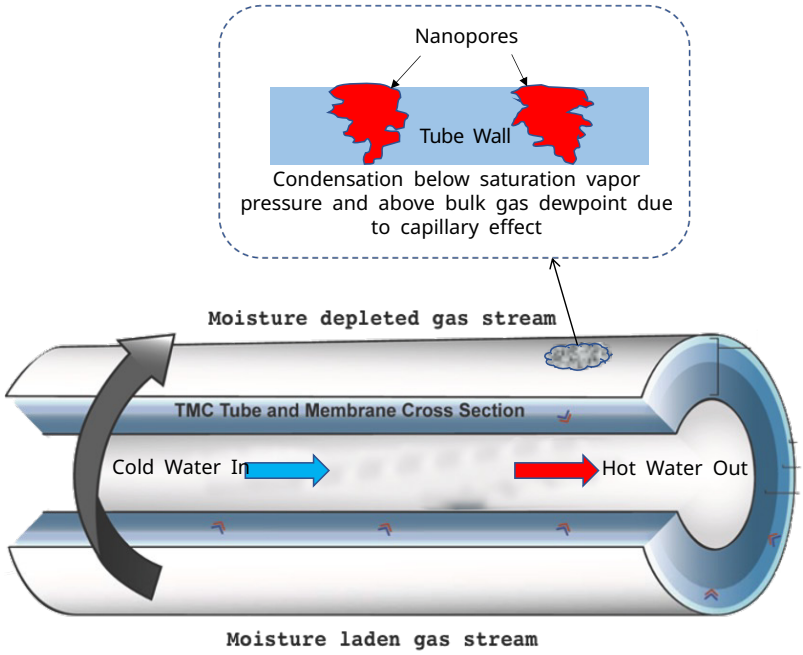
Bulk Gas Dewpoint: is the temperature the air needs to be cooled to (at constant pressure) in order to achieve a relative humidity (RH) of 100%. At this point the air cannot hold more water in the gas form and therefore the water condenses.

Capillary dewpoint: is the temperature at which water condenses from the vapor phase into a porous medium below the saturation vapor pressure, of the pure liquid. This result is due to an increased number of van der Waals interactions between vapor phase molecules inside the confined space of a capillary. In other words, capillary condensation occurs at temperature well above the bulk gas dewpoint.

When acidic gasses such as SOx, NOx and in some case Cox dissolve in water, which occurs once the water vapor from the gas phase becomes a condensate, it results in the formation of acids and turns the water acidic. The reaction kinetics are improved by lower temperatures, surface area and contact time.

In typical condensing heat exchangers or economizers, the gas is cooled below the bulk gas dewpoint to condense out the all the water from the gas streams. This creates a clear film of water on all the condensing surfaces which come into continuous contact with the gas stream providing adequate opportunity for the acid gasses to dissolve into the condensed water thereby producing acidic water. The reaction kinetics are favored due to the lower temperature, higher surface area and longer contact time.

In the case of TMCAqua, the nano-ceramic coating applied to the hollow fiber ceramic tubes is designed to create a pore geometry within the surface layer such that the pores or capillaries are roughly 10 to 20 nm which is the ideal size for allowing moisture to condense within them via capillary condensation.



Because the condensation happens in the capillaries **and** above the bulk gas dewpoint, while there is a presence of water in the capillaries which is quickly transported through the tube wall to the inside of the tube and collected as hot water, **the surface of the ceramic tubes remain dry**.

The gas containing the acidic gasses, namely SOx, NOx and COx, flow by the tubes at a typical gas velocity of 15 m/s and briefly come in contact, measured in nano-seconds, with the water in the capillaries. This ensures that the reaction kinetics are not favored in case of TMCAqua since a) the temperature is higher, b) smaller surface area (nanometers) and c) smaller contact time (nanoseconds).
Therefore the water condensed and collected by TMCAqua is non-acidic.