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Effect of external convection on evaporating cooling for a volatile meniscus

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Abstract

We present an experimental investigation for an evaporating ethanol meniscus formed inside a capillary tube of 1 mm. We show the effect of an imposed airflow on the temperature distribution of the meniscus when the airflow speed and direction are changed. We used an infrared camera to map the temperature in time and space at the meniscus pinned at the tube mouth. When airflow is blown around the tube mouth, the natural convection plume is either reduced in size and kept in the same direction (*assisting* flow), or bended upwards (*transverse* flow), or even inverted completely in an ascending plume (*opposing* flow). The measured evaporation rate is compared with the one derived from a simplified analysis showing a good agreement for 0.2 and 0.5 m s⁻¹ airspeed, but less accurate for the other cases. Some flow visualization of the Marangoni flow inside the tube is also presented.

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