LOW PRESSURE EVAPORATION OF BINARY PICOLITER DROPLET ON SUBSTRATE

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ABSTRACT: The free molecular evaporation of droplet on a substrate has many perspective scientific and industrial applications [1]. Results of our research of the low pressure evaporation of aqueous picoliter droplet have been recently published [2]. We use the same experimental technique for this work. Low pressure (20 - 80 Torr) evaporation of a picoliter water--ethanol droplet had been observed by the optic digital microscope through the glass hood. The evaporation time was determined by means of visualization. It is worthy to note that distinctive pinning effect during fast droplet evaporation was observed. After beginning of fast evaporation intermediate shape of picoliter droplets was practically cylindrical one. The initial droplet shape is strongly affected by its initial composition due to changes of surface tension. For picoliter droplets we didn't observed hydrodynamic flows on the droplet surface. Some surprising experimental results of droplet evaporation rate versus initial ethanol composition are shown in Fig.1. For further insight the mathematical model of evaporation process was developed. For simulation the trick of time reversal was used. Calculated and measured evaporation times are in good concordance. It was shown due to mathematical simulation that the interference of the mixing process and the evaporation are responsible for low evaporation rate at relatively high ethanol concentration. Also, the influence of the substrate temperature and its thermophysical properties on evaporation rate is discussed.

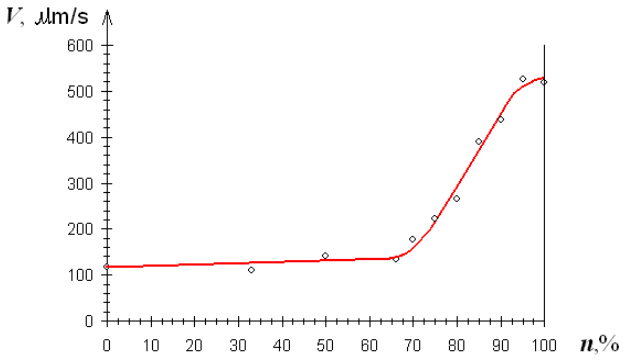

Fig. 1 Evaporation rate versus the concentration of ethanol.

References

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2. Saverchenko V.I. et al. Evaporation of a Picoliter Droplet on a Wetted Substrate at Reduced Pressure. J. Eng. Phys. and Themophys. 2010, **84** (4), p. 723