Comparison of high heat fluxes removal by decomposition aqueous mixture and superheated water

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The problem of removing high heat fluxes arises in pulsed devices with local heating. It is solved by integrating systems of microchannels with the circulation of a liquid heat carrier. Traditionally, water or an aqueous solution with an antifreeze component is used. A relatively new approach is focused on the use of partially miscible solutions with a liquid-liquid phase transition, but without intense evaporation or boiling. In the case of spinodal decomposition of such solutions, heat absorption is very intense.

The purpose of this work is to compare the heat transfer of a partially miscible solution during its liquid-liquid phase transition (spinodal decomposition) and during the boiling of its initial components. The objects of study were an aqueous solution of polypropylene glycol (PPG) and water. The method of controlled pulse heating of the probe (20–100) ms, based on the thermal mode of probe thermal stabilization at a given temperature (373–773) K, was used. The pressure in the cell varied from 1 to 30 MPa. The values of the heat transfer coefficient for an impulsively separating PPG aqueous solution and the corresponding values for boiling water under similar heating conditions are compared. The investigation has been conducted at the expense of a grant of the Russian Science Foundation (project No. 19-19-00115-P), https://rscf.ru/project/19-19-00115/.