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Experimental testing of the heating performance of a rotor-type dissipative liquid heater

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Abstract

The study focuses on the development of technology for volumetric noncontact liquid heating based on the dissipative liquid heating effect and realized in a high-gradient flow in the rotor–stator system of a hydrodynamic apparatus. In this paper, the heating performance of a prototype of a rotor-type dissipative liquid heater is studied, and the dynamics of several parameters, such as the heat power generated, the electrical power consumed and the efficiency factor, are defined. It is shown that the time evolution of the efficiency factor along with the other parameters displays a nonlinear character and depends on the flow pattern of the water–vapor system. It is found that the highest efficiency of the dissipative liquid heating of 91.6% is observed in the froth flow of the two-phase water–vapor system. In addition, potential industrial applications of the dissipative liquid heaters are discussed.

Notes

1. Here, the multiplier factor λ represents a property of compressible fluids, similarly to the shear viscosity μ, and takes into account the energy dissipation due to the volume change