Heat Transfer Enhancement Mechanisms in Oscillating Heat Pipes

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Heat transfer process in an oscillating heat pipe (OHP) involves liquid-vapor interfacial phenomenon, surface forces, thermally excited mechanical vibration, evaporation and condensation heat transfer, and oscillated forced convection. An OHP can effectively integrate thin film evaporation, oscillating flow, thermally-excited mechanical vibration, high heat transfer coefficient of entrance region, vortices induced by the oscillating flow of liquid plugs and vapor bubbles, and near-wall velocity overshoot (Richardson's annular effect), resulting in an extra high heat transport capability. In addition, the oscillating/pulsating motions in the OHP depends on the surface conditions, dimensions, working fluid, operating temperature, heat flux and total heat load, orientation, number of meandering turns, and, most importantly, the filling ratio.