

A new 3-omega technique for the measurement of thermal conductivity and diffusivity of cryogenic helium and hydrogen and their mixtures

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We present a new way to measure the thermal conductivity and diffusivity of cryogenic fluids using a modification of the 3-omega technique. These modifications include a wire-in-hole geometry that limits natural convection of the fluid around the measurement wire allowing for more accurate measurement. A complete theory of the thermal environment around the measurement wire is presented. This theory is validated by reference measurements on both hydrogen and helium, and to demonstrate the ability to perform diffusivity measurements in addition to conductivity measurements. Finally, completely new measurements on select hydrogen-helium mixtures are presented as well.

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