Bailey, Sean C. C.; **Kunkel, Gary J.**; **Hultmark, Marcus**; **Vallikivi, Margit**; **Hill, Jeffrey P.**; **Meyer, Karl A.**; **Tsay, Candice**; **Arnold, Craig B.**; **Smits, Alexander J.**

Turbulence measurements using a nanoscale thermal anemometry probe. (English)

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Summary: A nanoscale thermal anemometry probe (NSTAP) has been developed to measure velocity fluctuations at ultra-small scales. The sensing element is a free-standing platinum nanoscale wire, 100 nm $\times 2\mu$m $\times 60\mu$m, suspended between two current-carrying contacts and the sensor is an order of magnitude smaller than presently available commercial hot wires. The probe is constructed using standard semiconductor and MEMS manufacturing methods, which enables many probes to be manufactured simultaneously. Measurements were performed in grid-generated turbulence and compared to conventional hot-wire probes with a range of sensor lengths. The results demonstrate that the NSTAP behaves similarly to conventional hot-wire probes but with better spatial resolution and faster temporal response. The results are used to investigate spatial filtering effects, including the impact of spatial filtering on the probability density of velocity and velocity increment statistics.

MSC:

76-05 Experimental work for problems pertaining to fluid mechanics
76F99 Turbulence

Keywords:

MEMS/NEMS; turbulent flows

Full Text: DOI

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