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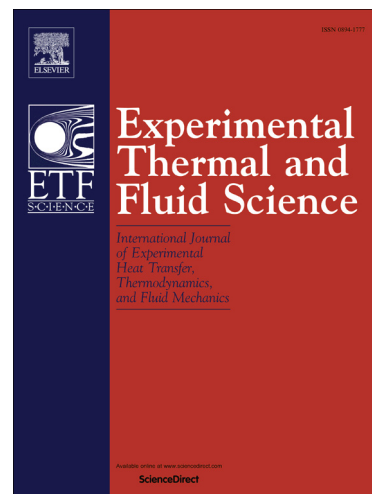
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Application of a Miniaturized Solid State Electrolyte Sensor for Tracer Gas Measurements in a Two-Stage Low Pressure Turbine

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Abstract

A new technique for tracer gas experiments in turbomachinery environments is presented. Instead of ethylene or carbon dioxide - as in previous publications - carbon monoxide is used as tracer gas. The measuring device is a miniaturized solid state electrolyte sensor built into the head of a traverse probe. Due to the lack of extensive tubing the design of the probe allows a short response time of the measuring system. The sensor characteristics, the calibration of the probe and the data analysis are described, and an estimation of measurement uncertainties as well as results from measurements within a two-stage low pressure turbine featuring hot streak injection are provided. Despite different sensor characteristics the results show good agreement between measurements with different probes. The overall quality of the results indicates that the developed technique is a valuable tool for the investigation of migration and mixing.

Keywords: solid state electrolyte sensor, tracer gas, diffusion, mass transfer, mixing, turbomachinery

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