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10.21 Surface eroding thermocouples for fast heat flux measurement in DIII-D

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A novel type of surface eroding thermocouple (SETC) has been tested and installed in the small angle slot (SAS) divertor of DIII-D for fast local heat flux measurements. The thermojunction of SETC is formed between two thin (10 micron) ribbons, which are filed over to create microfiber junctions. They are able to be exposed directly to the plasma at surface temperatures exceeding 2000°C and are capable of sub-10ms time resolution. Before installation in SAS, the SETCs were exposed at the lower divertor during L-mode and H-mode discharges, from which results are presented. In preliminary tests, SETCs proved to be a qualified diagnostic to accurately measure both the intra-ELM and inter-ELM heat flux during H-mode shots with high frequency ELMs (hundreds of Hz) and resolve heat flux profiles during strike point sweeps. The heat fluxes measured by SETCs have a good consistency with heat fluxes measured by IR camera and Langmuir probes. These new diagnostic capabilities will complement the existing IR camera measurements and will be of particularly significant value to measure surface heat flux in the SAS divertor or other regions where the IR camera lacks line-of-sight. US DOE support DE-SC0016318, DE-FC02-04ER54698, DE-AC05-00OR22725, DE-FG02-07ER54917, DE-NA0003525.

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