THERMAL DEPOSITION ANALYSIS DURING DISRUPTIONS ON DIII–D USING INFRARED SCANNERS*

R.L. Lee, C. Lasnier,† A.W. Hyatt, A.G. Kellman, and P.L. Taylor
General Atomics, San Diego, California 92186-9784
†Lawrence Livermore National Laboratory

The DIII–D tokamak generates plasma discharges with currents of up to 3 MA and up to 20 MW of auxiliary heating and current drive power from neutral beams and 2 MW of radio frequency injection. In a disruption a rapid loss of the plasma current and internal thermal energy occurs and megajoules of energy are deposited onto the torus graphite wall. Quantifying the spatial and temporal characteristics of the heat deposition is important for engineering and physics-related issues, particularly for designing future machines such as ITER. Using infrared scanners with a time resolution of 120 μs, measurements of the heat deposition onto the all-graphite walls of DIII–D during several types of disruptions have been made. Each scanner contains a single point detector sensitive to 8–12 μm radiation, allowing surface temperatures from 20°C to about 2000°C to be measured. A zinc selenide window which transmits in the infrared is used as the vacuum window. Views of the upper and lower divertor regions and the centerpost provide good coverage of the first wall for single- and double-null divertor discharges. During disruptions the thermal energy is not deposited evenly onto the inner surface of the tokamak, but is deposited primarily in the divertor region when operating diverted discharges. Analysis of the heat deposition during a radiative collapse disruption of a 1.5 MA discharge revealed power densities of 300–350 MW/m^2 in the divertor region. During the thermal quench of the disruption, the energy deposited onto the divertor region was more than 50% of the stored thermal energy in the discharge prior to the disruption. The spatial distribution and temporal behavior of power deposition during high β and high density disruptions will also be presented.

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Signature

Typed Name: R.L. Lee

Institution/Company General Atomics

Address P.O. Box 85608

City, Province, State/Postal Code
San Diego, California 92186-9784

Country USA

Phone: (619) 455-3331

Fax: 619 455-4190

E-mail: leer@gav.gat.com