Empirical Study of η_e in H-mode Pedestal in DIII-D *

R.J. Groebner,[1] T.H. Osborne,[1] A.W. Leonard,[1] M.A. Mahdavi,[1] P.B. Snyder,[1]
M.E. Fenstermacher,[2] and F.W. Perkins[3]

[1]General Atomics, P.O. Box 85608, San Diego, California 92186-5608, USA
[2]Lawrence Livermore National Laboratory, Livermore, California USA
[3]Princeton Plasma Physics Laboratory, Princeton, New Jersey USA

A physics based understanding of H-mode pedestal transport mechanisms is critically needed for predicting the pedestal structure of future tokamaks operating in H-mode. Although a validated model for transport in the pedestal does not exist, electron temperature gradient (ETG) turbulence has been proposed as a candidate for controlling the electron thermal transport. If ETG turbulence is important, one expected signature would be η_e values in the range of 1 to 2, where η_e is the ratio of scale lengths for electron density to electron temperature. Measurements of η_e of about 2 have been made in the ASDEX tokamak [1] and might be evidence for the existence of ETG turbulence. This paper will present some observations from the DIII-D tokamak that are consistent with these expectations for ETG turbulence and some that are not. As expected for ETG turbulence, the region of large gradient in the electron density always has a large gradient in the electron temperature. In the extreme case of the wide pedestals observed in VH-mode discharges, the regions of large gradient in both the T_e and n_e profiles tend to increase in width together as the VH-mode evolve. For a data set from standard H-mode discharges, in which the range of the pedestal electron pressure gradient spans more than an order of magnitude, η_e values in the range of ~1–2 are observed. However, the pedestal in the electron temperature often extends further into the plasma than the pedestal in the electron density [2]. These results imply that η_e can achieve very large values, which are not consistent with the simple picture of η_e turbulence discussed here. These results will be examined by comparing experimental values of the electron temperature scale length to predictions based on gyrokinetic simulations [3].

[1] J. Neuhauser, *et al.*, Plasma Phys Control. Fusion **44**, 855 (2002).
[2] R.J. Groebner, *et al.*, Nucl. Fusion **44**, 204 (2004).
[3] F. Jenko, *et al.*, Phys. Plasmas **8**, 4096 (2001).

*Work supported by the U.S. Department of Energy under Contracts DE-FC02-04ER54698, W-7405-ENG-48, and DE-AC02-76CH03073.