Formation of edge transport barrier and scaling of heating power threshold in CHS

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An improved confinement state by formation of an edge transport barrier (ETB) has been obtained in the Compact Helical System (CHS). Following injection of neutral beams, Hα emission intensities drop spontaneously. The electron density gradient near the plasma edge becomes steeper while the electron temperature profile keeps almost constant before and after a transition. Amplitude of electron density fluctuations in the edge region, which are measured with HCN laser scattering measurement, starts to decrease prior to the drop of Hα emission by about 3 ms. The time scale of the decrease in fluctuations is about 5ms and is longer than that of Hα emission. A power threshold exists, as is the case for the H-mode in tokamaks. The threshold depends on the electron density and the magnetic field strength and is well represented by the scaling $P_{\mathrm{th}}(\mathrm{MW}) = 0.50\,\bar{n}_{\mathrm{e}}(\times 10^{19}\ \mathrm{m}^{-3})^{0.36} \times B_{\mathrm{ax}}(\mathrm{T})^{0.64}$. These dependences are similar to that derived for tokamaks. The threshold also depends on magnetic configuration parameters such as the position of the magnetic axis. The ratio of the obtained threshold in CHS to the tokamak H-mode power scaling is in the range of 1-3 and depends on the configurations.