A series of proof-of-principle experiments of a new plasma thruster, TPDsheet device using ion cyclotron resonance (ICR), have been conducted with a helium sheet plasma. The resonance frequency of ICR heating is $\omega_r \approx 1.3 \omega_{ci}$ and this shift is in good agreement with the value predicted by the excitation of electrostatic ion cyclotron wave EIC. The propellant gas is helium at $1.34 \times 10^{-7}$ kg/s, DC discharge power is 13.5 kW, the stationary magnetic field is about 0.077 T. The thrust force depends the RF power of ICR heating and discharge current. At the discharge current of 60 A, the thrust force and specific impulse is obtained 6.7 mN and ~ 5100 s at the RF power of 300 W, respectively.

**Electron density $n_e$ vs discharge current $I_d$**

**Thermal energy $\Delta W_{\perp}$ and Thrust force $F$ vs RF power $P_{ICR}$**

**Conclusions**

Experimental results indicate that the acceleration of the high density sheet plasma above $10^9$ m$^{-3}$ is successful by the single passage of ions through the ICR heating region of the low RF power.