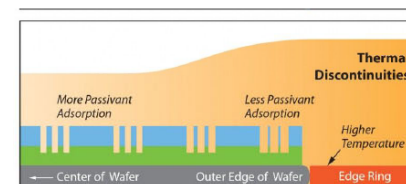
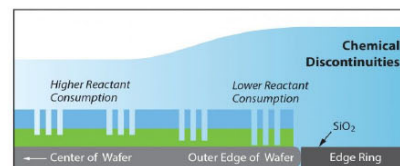
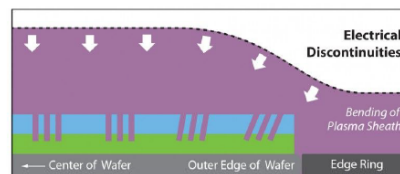


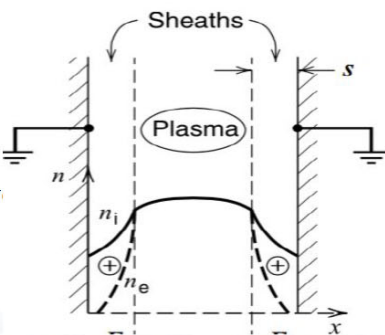
# Edge Non-uniformity in Plasma Processing

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- Wafer fabrication houses want to increase yield which lead to increase profits for their customers
- The outer edge of substrate (~10mm) is difficult to control
  - The edge accounts for up to 10% of the yield
- The abrupt end of the substrate surface creates inherent electrical discontinuities at the edge region, forming voltage gradients that bend the plasma sheath.
  - This causes a change in ion and neutral concentration and trajectory, which impact etch results and variability
- Process drift causes uniformity and selectivity problems over time



- Plasma sheaths are joined to wall surfaces across thin positively charged layers.
- The mean ion velocity at the plasma-sheath edge be equal to the Bohm velocity:  $u_B$
- Ambipolar Diffusion
- In a plasma, ions of charge  $+e$  and electrons of charge  $-e$ , can display interesting diffusivity behavior in external electric fields



- The solution is to smooth out extreme edge discontinuities and enhance edge performance, and this is done by tuning the plasma sheath at the edge to produce a constant, user-defined etch rate and ion angle.
- One strategy being used at Lam to achieve the degree of control now needed is providing numerous independent heaters or micro-zones to control the wafer temperature, which is a critical parameter impacting CD uniformity.

