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**ICRF performance with Metallic Plasma Facing Components: Revenge of the Sheath**[1]

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Ion cyclotron range of frequency (ICRF) heating is expected to provide auxiliary heating for ITER and future fusion reactors where high Z metallic plasma facing components (PFCs) are envisioned. The advantages of ICRF heating is the availability of relatively inexpensive high power sources and it can directly heat ions. For coupling, the antenna needs to be close to the plasma and antenna operation can be limited by compatibility (impurity generation, density production and erosion). Utilizing high Z PFCs, control of ICRF generated impurities becomes more important because the acceptable fractional high Z material concentration in the plasma is of order 1000 times less than low Z materials. In addition, low Z coatings applied in-situ, ie boronization, is often utilized to mitigate the high Z impurities in the plasma. However, erosion of these typically thin, low Z coatings will limit their effective lifetime. In Alcator C-Mod, we have investigated the compatibility of high power ICRF heating with high performance plasmas and high-Z PFCs with and without boronization. With boronization, record C-Mod stored energy and world record plasma pressures were achieved with 5.25 MW of injected ICRF power. However, impurity control through boronization is temporary and boronization appears to erode 3-5 times faster with ICRF compared with Ohmic H-modes. Experimental evidence suggests that RF-enhanced sheaths on open field lines are responsible for enhanced erosion and impurity influx. Utilizing localized boronization, we have determined that the primary impurity source is outside the divertor and we demonstrated that the erosion location is linked to the active antenna. Furthermore, we observed that erosion rate associated with ICRF heating was unaffected by the heating scenario's single pass absorption. Using a 3-D antenna code coupled to a full wave solver we will present the influence antenna geometry has upon sheaths and possible mitigation strategies.

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