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Determining impurity concentrations in plasmas with mixed low-Z and high-Z contamination[1] M. REINKE, M. CHILENSKI, T. CHRISTENSEN, P. ENNEVER, I. FAUST, S. HARPER, N. HOWARD, D. MILLER, MIT - Plasma Science and Fusion Center, A. JAMES, Lawrence Livermore National Laboratory, M. CHURCHILL, C. FIORE, M. GREENWALD, J. HUGHES, A. HUBBARD, B. LIPSCHULTZ, E. MARMAR, J. RICE, C. THEILER, MIT - Plasma Science and Fusion Center — A novel approach is described to find concentrations of impurities in plasmas with a mix of low-Z and high-Z contaminants. In plasmas with high-Z impurities, ΔZ_{eff} $\sim$1 can be reached without meaningful change to the main-ion density, meaning changes in the high-Z concentrations can contribute to collisionality, without playing a role in dilution. When both low-Z and high-Z impurities are present, Z_{eff} measurements have limited utility, requiring an expanded approach in characterizing the contamination. The cumulative effect of low-Z impurities is to reduce the neutron rate, while high-Z impurities dominate the total radiated power. Alcator C-Mod has range of low-Z (B, C, O and F) and high-Z (Fe, Mo) intrinsic impurities, and uses extrinsic seeding of N_2, Ne (heat flux), He and Ar (diagnostic). Impurities are identified via short-wavelength, $\lambda < 30$ nm, line emission measured by flat-field spectrometers, which can also track the relative inter- and intra-shot changes in line-brightness. The absolute high-Z impurity density is constrained using resistive bolometry, while the total low-Z impurity density is constrained by comparing the measured and modeled neutron rates using experimental T_i profiles. Continuum emission in multiple spectral regions is used to determine Z_{eff}.

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