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Combined complementary plasma diagnostics to characterize a 2f plasma with additional DC current with conditioning effects at the chamber wall MICHAEL KLICK, RALF ROTHE, Plasmetrex GmbH, KYE HYUN BAEK, EUNWOO LEE, Semiconductor RD Center, Samsung Electronics Co. — Multiple frequencies and DC current used in a low-pressure plasma rf discharge result in an increased complexity. This needs plasma diagnostics applied, in particular in a plasma process chamber. That is done under manufacturing conditions which restrict the applicable plasma diagnostics to non-invasive methods with small footprint. So plasma chamber parameters, optical emission spectroscopy (OES), and self-excited electron spectroscopy (SEERS) are used to characterize the plasma and to understand chamber wall conditioning effects in an Ar plasma. The parameters are classified according to their origin the region they are representative for. The center ion density is estimated from the DC current and compared to the SEERS electron density reflecting the electron density close to that at the chamber wall. The conditioning effects are caused by Si sputtering at a Si wafer changing the chamber wall state only when the chamber is clean, subsequent plasmas in the same chamber are not affected in that way. Through the combination of the complementary methods it can be shown that the chamber wall condition finally changes the radial plasma density distribution. Also the heating of electrons in the sheath is shown to be influenced by conditioning effects.

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