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Breakdown at chamber wall in ICP/CCP PECVD plasma caused by higher harmonics MICHAEL KLICK, Plasmetrex GmbH — A serious problem in ICPs at low pressure for deposition of dielectric layers (HDP-PECVD) is the occurrence of electrical breakdowns at the inner wall of the process chamber. In a production chamber where this was found, such an event has a strong influence on the yield of the wafer. Chamber materials, mainly Al, is melted out of the chamber wall, negatively charged in the plasma, jumps as a hot, liquid Al ball across the wafer and remains finally at the wafer surface. This is shown by REM pictures and breakdown movies. Due to the loss of yield, it is important to detect arcing in real time and to eliminate its root cause. The occurrence of arcing is verified by an asymmetry parameter of the plasma which is calculated from the chamber wall current within the SEERS algorithm. It can be understood as the ratio of the RF voltages across the boundary sheath at the grounded chamber wall and the wafer at hot (RF driven) electrode. The asymmetry responds with a strong peak if the arcing occurs which enables arcing detection in real-time. It was found that the probability of this plasma-driven breakdown is higher at low pressure process conditions, i.e. this method should be also applicable on dry etch processes which run with lower pressure usually. It will be demonstrated that this was driven by higher harmonics of the 13.56 MHz potential of the wafer electrode. The exchange of RF components, strictly RF matchbox, influences the amount of harmonics and so the probability of the breakdowns. There are some potential mechanisms, there discussed which in simple 2d plasma model showing a spatial variation of the harmonic content of the sheath voltage at the wall.

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