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Novel Helmholtz-Inductively Coupled Plasma Source for Nano-scale MOSFETs KUN-JOO PARK, KEE-HYUN KIM, WON-MOOK LEE, DMS Co., Ltd, #402, Sungshin Techno-Park Bldg. 509-7, Suwon, 443-803, Korea, HEEYEOP CHAE, Dept. of Chemical Eng., SungKyunKwan Univ., Suwon, 440-746, Korea, IN-SHIK HAN, HI-DEOK LEE, Dep. of Electronics Eng., Chungnam National Univ., Yuseong, Daejeon, 305-764, Korea — As the minimum feature size of MOSFET was continuously scaled down to the nano-scale regime, fine pattering using plasma etching process has become crucial in fabricating ULSI devices. Novel Helmholtz coil inductively coupled plasma (H-ICP) etcher is proposed and characterized for deep nano-scale CMOS technology. Various hardware split tests such as the distance between top and bottom coils, the distance between chamber ceiling and wafer, and the chamber height are applied for optimal design of the chamber or process condition. The uniformity is significantly improved using the optimum conditions. The plasma density obtained with H-ICP source was about 5×10^{11} /cm^3, and electron temperature was about 2$\sim$3eV. The etching selectivity of polysilicon gate to ultra-thin gate oxide is 482:1 with 10sccm of HeO_2. In this work, a novel H-ICP source was proposed for plasma etching with high uniformity and high selectivity suitable for nano-scale semiconductor devices.. Various kinds of split were applied and the optimum condition was successfully applied for formation of nano-scale poly gates. The proposed H-ICP is successfully applied for formation of under 60 nm gate layers.

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