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Plasma induced chemistry of self-assembled nanoparticles and underlying surface for High-k film growth[1] TAKESHI KITAJIMA, TOSHIKI NAKANO, National Defense Academy — The novel film growth process with plasma induced reaction of metal nanoparticles and the substrate is demonstrated for HfSiON. We applied N_2 plasma for the interfacial reaction and nitridation of Hf nanoparticles on SiO_2/Si(100) substrate to form HfSiON from metal source. The system consists of a UHV-SPM chamber with an e-beam metal evaporation source, a separate VHF (50MHz) low pressure ICP plasma source, and ex-situ XPS. Commercial Si(100) wafer with oxide surface layer is introduced to the chamber and Hf metal beam is exposed to the surface at room temperature. The morphological development of the surface is analyzed with the in-situ non-contact AFM. The N_2 ICP is exposed to the sample. AFM image shows the self-assembled Hf nanoparticles on SiO_2 surface after the Hf deposition. Dome shaped particles with 3-6 nm width are close-packed on the surface with high density of 8.5×10^{12} cm^{-2}. The N_2 ICP exposure induces the interfacial reaction of the Hf nanoparticle/SiO2/Si structure and forms HfSiON(film)/SiON/Si due to the XPS analysis.

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