Low temperature ultra-thin silicon oxide fabricated by plasma immersion ion implantation

Julian Duchaine[1], Shay Reboh[*†2], Frank Torregrosa[1], Fréderic Mazen[2], and Fréderic Milesi[2]

[1]Ion Beam Services (IBS) – Ion Beam Services – France
[2]Laboratoire d'Electronique et des Technologies de l'Information (LETI) – CEA – MINATEC 17, rue des Martyrs, 38054, Grenoble Cedex 9, France

Abstract

Here, we report on the fabrication of a low temperature (< 300 ∘C) surface layer of silicon oxide on Si substrates, using the plasma immersion ion implanter Pulsion®. Before each implant, a chemical solution was used to remove the native silicon oxide. Oxygen implant conditions were optimized in order to obtain a thin oxide layer (< 10 nm) at the wafer surface. We used O2 as gas precursor and a negative voltage of 1 kV to extract ions from the plasma. The implantations were performed with the substrate heated to 100 ∘C or 300 ∘C with different plasma conditions. The oxygen concentration profiles were measured by Secondary Ion Mass Spectrometry. To study the chemical composition of the surface layer, we analysed the substrates using X-Ray Photoelectron Spectrometry. In addition, the roughness of the surface was characterized by Atomic Force Microscopy. Our results show that using Pulsion® tool we are able to produce oxide layers having the stoichiometric SiO2 composition already at the as-implanted state. In terms of roughness, the implanted wafers are comparable to pristine substrates.

Keywords: silicon oxide, ion implantation, low temperature

[*]Speaker
[†]Corresponding author: shay.reboh@cea.fr