Effects of ammonia-ambient annealing on physical and electrical characteristics of rare earth CeO_2 as passivation film on silicon

ABSTRACT

Effects of post-deposition annealing at 400–1000 °C in ammonia (NH_3) gas ambient towards physical and electrical characteristics of metal-organic decomposition derived CeO_2 films spin-coated on n-type Si substrates were studied. The use of NH_3 annealing as N and H sources has promoted nitridation and passivation occurring at interface between the CeO_2 and Si. Mixed oxidation states (Ce^{4+} and Ce^{3+}) were detected in the samples via the detection of CeO_2 and Ce_2O_3 phases, confirmed using high resolution X-ray diffraction analysis, Raman, and Fourier Transform Infrared studies. An increase in nitridation effect with respect to temperature has impeded the formation of $Ce_2Si_2O_7$ interfacial layer (IL) while the enhancement of passivation effect has triggered a decrease in interface trap density. Corresponding effects towards metal-oxide-semiconductor characteristics of the samples were discussed in details.

Keyword: Rare earth; CeO2; Ammonia annealing; Nitridation; Passivation