

Effects of ammonia-ambient annealing on physical and electrical characteristics of rare earth CeO₂ as passivation film on silicon

ABSTRACT

Effects of post-deposition annealing at 400–1000 °C in ammonia (NH₃) gas ambient towards physical and electrical characteristics of metal-organic decomposition derived CeO₂ films spin-coated on n-type Si substrates were studied. The use of NH₃ annealing as N and H sources has promoted nitridation and passivation occurring at interface between the CeO₂ and Si. Mixed oxidation states (Ce⁴⁺ and Ce³⁺) were detected in the samples via the detection of CeO₂ and Ce₂O₃ 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 Ce₂Si₂O₇ 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