AI2O3-Y2O3 ULTRATHIN MULTILAYER STACKS GROWN BY ATOMIC LAYER DEPOSITION AS PERSPECTIVE FOR OPTICAL APPLICATIONS

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Nanolaminate multilayers made of Al2O3 and Y2O3 bilayer slabs were grown at 250 °C by means of thermal Atomic Layer Deposition (ALD). Several samples were prepared, where the number of ALD cycles for the Al2O3 slab was kept constant at 17 ALD cycles, while the number for the Y2O3 slabs was varied from 1 to 100. An optical model was built and adapted for each sample considering the Cauchy relationship, which was used to simulate the optical response for transparent materials. The thickness obtained from the optical model was in agreement with the thickness of cross-sectional SEM images. The optical band gap, obtained from single-effective-oscillator model, varied from 5.45 to 4.24 eV as a function of the Y2O3 slab thickness. The refractive index as well as the optical band gap can be modulated systematically using the Al2O3:Y2O3 ratio as control parameter. By means of simulated propagation modes it is shown that there is a multimode behavior for thickness around 200 nm at wavelengths between 300 and 1550 nm. This study reveals the possibility of using Al2O3-Y2O3 nanolaminates as the core of optical waveguides. It also shows the potential of ALD technique for fabrication of submicron waveguides useful in miniature optical circuits.

Keywords: Optical properties, Atomic Layer Deposition, Multilayers

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