Band gap tuning of amorphous Al oxides by Zr alloying

The optical band gap and electronic structure of amorphous Al-Zr mixed oxides, with Zr content ranging from 4.8 to 21.9%, were determined using vacuum ultraviolet (VUV) and X-ray absorption spectroscopy (XAS). The light scattering by the nano-porous structure of alumina at low wavelengths was estimated based on the Mie scattering theory. The dependence of the optical band gap of the Al-Zr mixed oxides on Zr content deviates from linearity and decreases from 7.3 eV for pure anodized Al2O3 to 6.45 eV for Al-Zr mixed oxide with Zr content of 21.9%. With increasing Zr content, the conduction band minimum changes non-linearly as well. Fitting of the energy band gap values resulted in a bowing parameter of 2 eV. The band gap bowing of the mixed oxides is assigned to the presence of the Zr d-electron states localized below the conduction band minimum of anodized Al2O3.

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