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Electrical and Optical Properties of BON and Ti-BON Thin Films Prepared by PAMOCVD Method

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We have firstly grown the BON and Ti-BON thin films on Si(100) in the deposition temperature range RT~500℃ by low frequency R.F. derived plasma assisted MOCVD. Trimethylborate(TMB) and tetrakis dimethyl amino titanium(TDMAT) precursors were used to grow BON and Ti-BON thin films. N2 gas as additional nitrogen source was used for reactive gas and the plasma source gas was Ar. Comparative studies of electrical and optical properties between BON thin film and Ti-BON thin film were mainly investigated in this study. FT-IR result shows that the bond type in the films is very similar to B-O-N and prefer to angular structure rather than linear one. UV/Vis. results show that BON is semiconductor material with 3.4 eV of wide band gap, and PL results show that the optical band gap is 3.5 eV. It means that the conduction band gap is less than the optical band gap. Thus, the BON film gained in this case was a band structured material with heavy doping. In terms of the I-V curve and film thickness, the electric conductivity is deduced as 8×10-2 (Ωcm)-1, which is as same order-magnitude as 4.3×10-2 (Ωcm)-1 measured by 4-points probe method. This means that the BON thin films could have a semiconductor nature. Similar results as BON were also obtained from Ti-BON thin films grown under the same deposition condition. However, we found that electrical and optical properties of the as-grown Ti-BON thin films were strongly dependent by nitrogen flux and growth time. Typically, the electrical resistance was decreased with increasing the nitrogen flux and growth time.