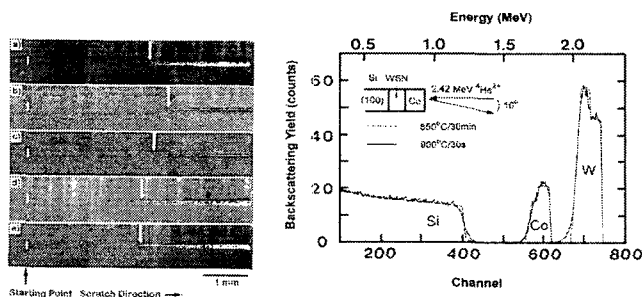


## Improvement of adhesion strength of W-B-N glue layer on Si for magnetic devices

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The structural and the mechanical properties of tungsten boron nitride (W-B-N) thin films[1] were studied to investigate the effects of boron and nitrogen in the 1000 - 2000 Å W-B-N glue layer. The W-B-N thin films were deposited by using the RF magnetron sputtering method. The substrates were p-doped (100) Si wafers with a resistivity of 5-6 Ω-cm. Prior to the sputtering, the substrates were degreased, spin-dried, and loaded into the reactor. The sputtering targets were a W target with a purity of 99.99% and a W<sub>2</sub>B target with a purity of 99.95%. Before the deposition, Ar pre-sputtering was performed to remove the native oxide layer on the target. The flow rates of mass-flow controllers. The total pressure of (N<sub>2</sub> + Ar) was varied in the range of 0 - 30%. The RF power density of W was fixed at W/cm<sup>2</sup> whereas that of W<sub>2</sub>B was varied from 0.4 to 0.7 W/cm<sup>2</sup>. The impurities of the W-B-N thin films provided a stuffing effect that was very effective for preventing interdiffusion between the interconnection metals or magnetic thin films and the silicon during the subsequent high temperature annealing process. In order to improve the adhesion of interconnecting metals or magnetic thin films, this WBN glue layer is interposed between magnetic thin film and Si. The acoustic emission-load graph obtained by the scratch test method show that the adhesion strengths of magnetic films on the WBN glue layers are apparently improved from 9-11 of W-N glue layer[2] to 26-30 N of W-B-N glue layer. The more adhesive contact can be attributed to the introduction of boron and nitrogen interstitials because these boron and nitrogen interstitials are expected to modify the structural properties such as porosity and vacancies in the WBN films. And boron and nitrogen interstitials are also reduced the stress and it is showed that adhesion strength is closely related with the reduced the stress. 1000Å-thick W-B-N glue layer is interposed between Co and Si, this layer maintains its chemical integrity up to 850C for 30min.



### References

- [1] C.W. Lee, Y.K. Park, S-I. Kim, and Y.T. Kim, J. Kor. Phys. Soc., **37(3)**, 324 (2000).
- [2] Y.T. Kim, and C.W. Lee, Appl. Phys. Lett. **61(5)**, 537 (1992).