PO2052

Superhard SiC thin film deposited by unbalanced magnetron sputtering method

Young-Joon Baik[1], K.-W. Lim[2], Y.-S. Shim[2], J.-H. Lee[3], J.-Y. Hur[4], J.-K. Park[2], W.-S. Lee[2]

[1]Korea Institute of Science and Technolog, Seoul, South Korea [2]KIST, Seoul, South Korea [3]KITECH, Incheon, South Korea [4]Korea University, Seoul, South Korea

yjbaik@kist.re.kr

Silicon carbide (SiC) thin films were studied with a view point of their superhardness property. Substrate bias voltage and deposition temperature, as deposition variables of unbalanced magnetron sputtering process, were chosen as parameters possibly influencing the superhardness because those variables are known to affect particles energy participating in the film deposition. Sintered SiC target, connected to a direct current power supply was used as a sputter terget anda single crystal Si wafer was used as a substrate. The bias voltages, applied to the substrate were controlled in the range ofrom 0 to -100 V. Deposition temperatures were adjusted between room temperature and 500 ºC. The hardness of deposited SiC films were analyzed to vary 30 and 50 GPa according to the deposition condition. A critical values of bias voltage and deposition temperature were required to obtain the superhard SiC thin films: in the present case, deposition at temperatures above 400 ºC was mendatory for the superhardness where the substrate bias should be lower than -60 V. We characterized the bonding and crystal structure using Raman Spectroscopy as well as X-ray diffraction. The microstructures of the film were also analyzed usin transmission electron microscopy. Those analyses have shown that the films showing the superhardness were made of nano-composite of nano-width columnar SiC crystalline grains embedded in an amorphous SiC matrix, while other films were amorphous. Those microstructural characteristics were believed to the origin of the superhardness based on the general explanation suggested by Musil's group.

Keywords
silicon carbide
thin film
superhardness
nano-columnar crystal grain
nano-composite