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The surface structure and interfacial reaction analysis of W in 6H-SiC

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Abstract content
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Tungsten thin film was deposited on bulk single crystalline 6H-SiC substrate and annealed in vacuum at temperatures ranging from 500 to 1000 °C for 1h. The resulting solid state reactions (phase composition) and surface morphology were investigated by Rutherford backscattering spectroscopy (RBS), grazing incidence X-ray diffraction (GIXRD), scanning electron microscopy (SEM) and atomic force microscopy (AFM). The RBS spectra were simulated using the RUMP software in order to obtain the deposited layer thickness, reaction zone compositions and reaction zone thickness. The as-deposited spectra fitted well with those annealed at 500 and 600 ℃. This indicated that there was no reaction taking place at these two temperatures. At temperatures of 700 ℃ and above, W reacted with the SiC substrate and formed a mixed layer of carbide and silicides. XRD was used to identify the phases present and to confirm the RBS results. WC and WSi2 were the initial phases formed at 700 °C. At 800 and 900 °C, additional carbide and silicide phases (that is W2C and W5Si3) were also present; while at 1000 °C, tungsten carbide with different compositions together with both the silicides were present. The SEM images of the as-deposited, 500 °C and
600 °C annealed samples showed uniform granular surface of W. The W layer became heterogeneous during annealing at higher temperatures as the W granules agglomerated into island clusters at temperatures of 800 °C and higher.

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