

Thermal Annealing Effect on Structural Properties of Silicon- Rich $\text{Si}_x\text{C}_{1-x}$ Thin Films Deposited by R.F. Sputtering

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Abstract:

Si-rich silicon carbide ($\text{Si}_x\text{C}_{1-x}$) thin films have been deposited by radio frequency (RF) co-sputtering. These films were deposited, at 250W RF power, from a composite target consisting of crystalline silicon fragments regularly distributed on the surface of a pure graphite target. The surface covered by the Si fragments is about 67% of the total target surface. The as-deposited films were annealed by rapid thermal (15 min) annealing under inert atmosphere (Ar) at different temperatures ($T_a = 700, 850$ and 1000°C).

The influence of annealing on structural properties of $\text{Si}_x\text{C}_{1-x}$ films was investigated by Fourier Transform Infrared (FTIR) and Raman spectroscopy techniques.

The FTIR investigations show, in addition to the expected Si-C bonds, the formation of Si-O bonds due to the presence of oxygen gas in the atmosphere. The increase of annealing temperature leads to an increase of both Si-C and Si-O bonds densities and the corresponding bands shifts to higher wave numbers. Such behaviour is characteristic of a preceding crystallization of SiC and SiO_2 .

The Raman spectra show three regions related to the different Si-Si, Si-C and C:C (D-band and G-band) vibration modes. Raman results suggest that C:C and Si-Si bonds present inside the material are probably isolated or located in small clusters. After annealing at 850°C , the disappearance of a-Si band indicates a crystallisation of the Si clusters.

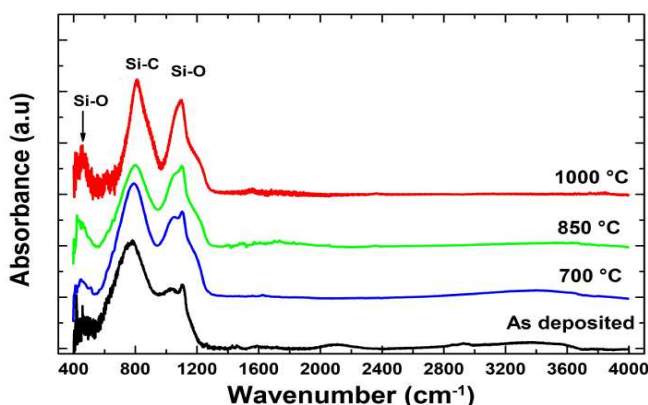


Figure 1: FTIR spectra of $\text{Si}_x\text{C}_{1-x}$ films before and after annealing at different temperatures

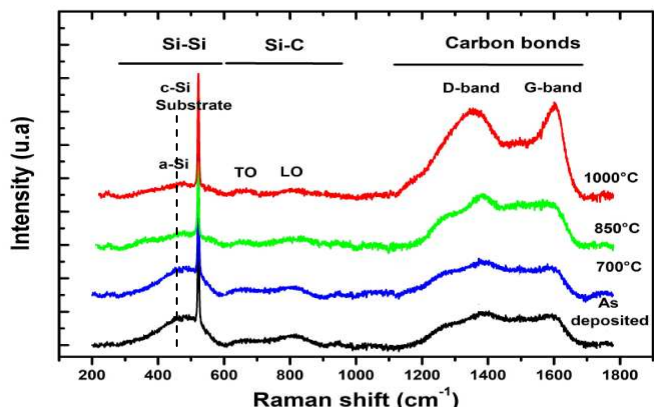


Figure 2: Raman spectra of $\text{Si}_x\text{C}_{1-x}$ films before and after annealing at different temperatures