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Surface hardness of flexible carbon fiber sheets enhanced by deposition of organosilicon oxynitride thin films with an atmospheric pressure plasma jet

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The transparent polymers reinforced by carbon fiber cloth, so-called flexible carbon fiber sheets (FCFS), are frequently exploited due to several advantages such as low specific weight, low cost and ease of processing. However, the soft surfaces of FCFS restrain their usage. The constrains of soft surfaces for FCFS can be resolved by deposition of hard transparent protective thin films, such as SiO2 and Al2O3 onto the surfaces of transparent polymers. An enhancement on surface hardness of FCFS) substrates by deposition of organosilicon oxynitride (SiOxCyNz) with an atmospheric pressure plasma jet (APPJ) by mixing the tetramethyldisiloxan (TMDSO) vapors with O2 gases, injecting into air plasma jet and sprayed onto FCFS substrates at room temperature (~23℃) and an atmospheric pressure is investigated. Surface hardness of the FCFS substrate is improved form 2B for as-received FCFS substrate to 8H for FCFS/APPJ-synthesized SiOxCyNz while tested by the pencil test method (ASTM3363). The nanograins, and the chemical bonds Si-(O)4 and (R)-Si-(O)3 produced in APPJ-synthesized SiOxCyNz thin films results in a high surface hardness of up to 8H against the pencil 8H scratched under a loading of 765 g at an angle of 45o.

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