Investigation of robust superhydrophobic surface usingatmospheric pressure plasma jet

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An atmospheric pressure argon plasma jet basedon dielectric barrier discharge (DBD) was employed to obtainrobust superhydrophobic coating onto glass substrates. Hydrophobic coatings often suffer mechanical instability and donot function well after abrasion/scratching. Two precursors, namely, tetramethylsilane (TMS)and 3-aminopropyl(diethoxy)methylsilane (APDMES) were used to get robust andsuperhydrophobic thin film. TMS is well known precursor for promotinghydrophobic surface but its thin film is not mechanically stable fora longer time. On the other hand, APDMES is one of themost widely used silanes for its covalent characteristics with adrawback of hydrophilic nature. Due to its covalent characteristics, itssurface energy is higher than TMS which produce a stable robustsurface for a longer time. The goal ofthis work was to determine optimum mixture of thesetwo precursors that can make long lasting robust hydrophobic thinfilm on the glass surface. A high voltage ac power source(operating frequency: 11.5 kHz) was employed to generate atmosphericpressure plasma jet. Atomic force microscopy (AFM), scanning electron microscopy(SEM), Fourier-transform infrared spectroscopy (FTIR), X-ray photoelectronspectroscopy (XPS), and scratch test were performed to analyze thecoating layer formed on the glass surface. It was observed that the wearresistance depends on the thickness and the Si-O-Si content of the coatings. Adurable robust coating layer and water contact angle (WCA) of 163°were achieved with an optimal APDMES/TMS ratio of 1.7.