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Fabrication of Transparent Superhydrophobic Polytetrafluoroethylene Coating

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Abstract

Polytetrafluoroethylene (PTFE) thin films were successfully deposited on a glass substrate using pulsed laser deposition, with deposition times ranging from 30-120 minutes. The surface roughness of the films increased as deposition time increased, with micro/nanoscale roughness developing when deposition time increased over 60 minutes. This roughness made the surface superhydrophobic, having a contact angle of about 151.6^{o} ±1. UV-vis spectroscopic analysis of the PTFE films revealed that they were highly transparent, up to ~90% in visible and near-infrared ranges. Furthermore, when the deposition time was increased—which increased the films' thickness—the films were able to absorb 80%–90% of ultraviolet light in the wavelength range <300 nm. The researchers analyzed the PTFE films with an x-ray photoelectron spectrometer to find the chemical and elemental composition of their surfaces. Atomic force microscopy was used to determine the effect of surface roughness on hydrophobicity. These films have many potential practical uses, from self-cleaning materials to solar cell panel coatings. Additionally, the low dielectric properties of PTFE make it ideal for communication antenna coatings and similar applications.

- Pulsed laser deposition (PLD) was used to deposit PTFE thin films on glass substrates at room temperature.
- The prepared films show superhydrophobic behavior, with water contact angles over 150^{o}.
- The low surface energy of PTFE polymers combined with the roughness provided by PLD is responsible for the films' superhydrophobicity.
- The films have very good transparency: up to 90% in the visible and NIR ranges.