Interfacial Morphology of TPU Filament on Plasma-Treated Textiles: A 3D Surface Analysis Approach|

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➢ INTRODUCION

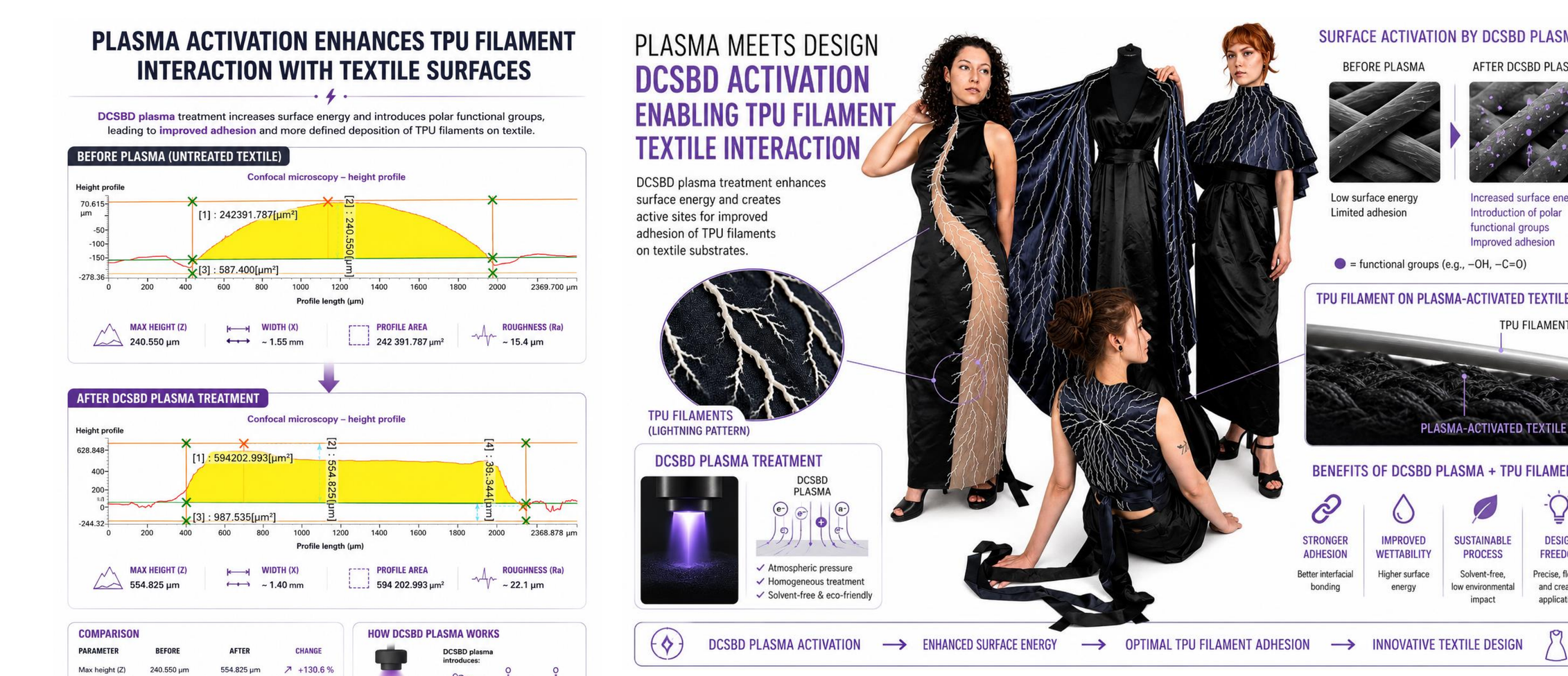
The integration of 3D-printed TPU structures with textile materials can be significantly improved through DCSBD plasma surface treatment. This research investigates the influence of plasma modification on the adhesion and durability of TPU filaments applied to textile fabrics. The results demonstrate the potential of plasma-treated textiles for advanced functional and design-oriented textile systems, with promising applications in smart textiles, wearable structures, plasma-assisted additive manufacturing, and contemporary fashion-design experimentation

➢ METHODS

- Five textile substrates with different structures were investigated, including cotton satin, polyester satin, polyester lining fabric, polyester-lycra tulle and linen-viscose fabric.
- TPU filament was selected due to its flexibility and compatibility with textile materials. DCSBD plasma treatment was used to modify textile surface properties before TPU application.
- Plasma activation increased surface energy and improved interaction between TPU filament and textiles.
- Different textile structures showed different responses to plasma treatment.
- AFM analysis was used to evaluate surface morphology and roughness changes after plasma exposure.
- AFM revealed localized modifications of fiber surfaces and changes in surface texture.
- The combination of plasma and TPU deposition created visually and technologically functional textile interfaces.
- The results confirmed the suitability of DCSBD plasma for advanced textile modification.
- The study demonstrated the potential of combining plasma technology, textiles, and TPU filament in material engineering and design applications.

➢ THE RESULTS

The results also indicate significant potential for future applications in smart textiles, wearable structures, plasma-assisted additive manufacturing, and interactive educational visualization of material interactions.



Confocal analysis demonstrated that the interaction between TPU filament and textile substrate strongly depends on the textile structure, porosity, and fiber arrangement in combination with the selected filament type. Significant differences were observed in filament spreading, localization, and penetration behaviour between woven, knitted, and mesh-like textile substrates after DCSBD plasma activation.

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