# Transparent Nano Coating for Rhizotron Studies

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Project aims:

This project aims to solve problems of scratches and condensed water of polycarbonate for rhizotron studies as follows;

- To develop a nano-coating solution using colloidal silica via a sol-gel process to create a transparent anti-scratch coating in the front panel of polycarbonate by using the flow coating technique.
- To enhance the nanolayer properties (e.g., anti-fingerprint, anti-dust, hydrophobicity) with Fluoroalkylsilane (FAS) as an additive solution and test these properties by using standard nano-characterization protocols.
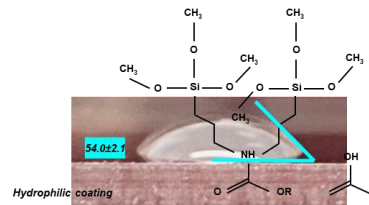
The problems of rhizotron studies

1 — Roots / Scratches
2 — Condensed water
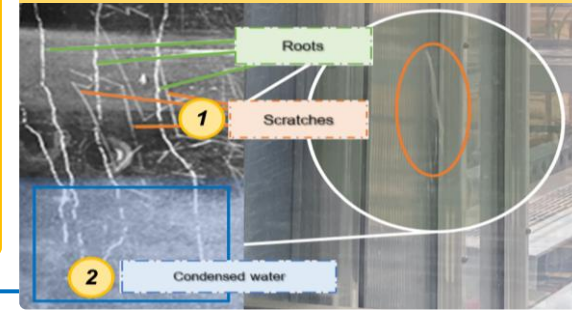
Strategy to achieve these goals:

PC Substrate cleaning

71.7 ± 0.2

PC substrate — O—O—R
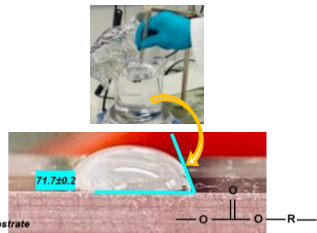
Immersing a substrate in isopropyl alcohol solution (IPA)

Hydrophilic coating

54.0 ± 2.1

Hydrophilic coating

Soaking a substrate in Bis[3-(trimethoxysilyl) propyl]amine (bis-TPA) solution

Hydrophobic coating
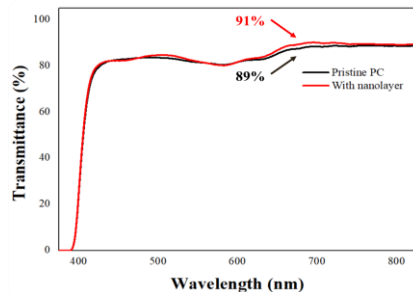
122.2 ± 2.4

Hydrophobic coating
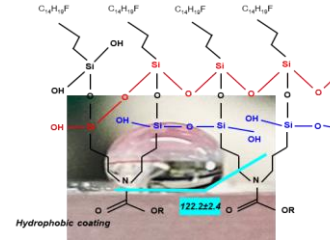
Coating of nanolayer by using nanosilica solution via a flow coating technique

Properties testing and Characterization

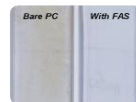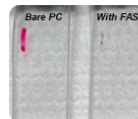AFM, FTIR, SEM, Contact angle, UV-Vis spectroscopy, and, etc.

Results:

91%
89%

— Pristine PC
— With nanolayer

(b) Transmission properties

(a) Hardness properties

5 / 9 — Bare PC / With FAS

(c) Anti-dust — Bare PC / With FAS

(d) Anti-fingerprints — Bare PC / With FAS

(e) Hydrophobic properties — 122.2 ± 2.4

Achievements:

- Increased hardness film from 5H of bare PC to 9H of coating layer to protect scratches by soil, sand, and damage by cleaning process or installation (a).
- Increased light transmission with coating of nanolayer (b).
- Added the properties of removal dust and permanent marker after wiped with tissue paper (c and d).
- Improved hydrophobicity properties to prevent condensed water on the rhizotron panel (e).