Multi-functional Nanofilm with High Strength

A Free-standing and Self-supporting Porous Polymer Nanofilm

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Background

Self-supporting and porous polymer nanofilms at thicknesses ~100 nm are enabler materials for a myriad of cutting edge technologies. In this invention, a new and facile method for the fabrication of a self-supporting, robust and breathable polymer nanofilm has been developed. The film is extruded, stretched and annealed, to have a film thinner than human hair and yet over twice stronger than stainless steel. Considering how light polyethylene (PE) plastic is compared to steel, the nanofilm is over fifty times stronger than that of stainless steel with the same mass. Besides the mechanical strength, the nanofilm possesses other advantages such as extremely transparent, gas-permeable, water-proof and tunable porous properties, making it suitable for use as wearable devices, electronics, batteries, solar cells, nanofiltration, and many other cutting edge technologies.

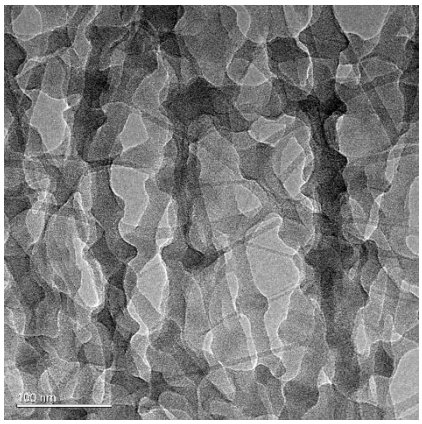
Technology Overview

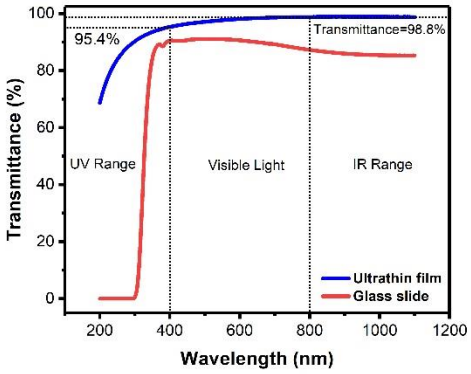
Conventional ultra-thin film is prepared by spin coating, dip coating, self-assembly and electro-spinning. The resultant ultra-thin film is hard to prepare and handle due to its uneven thickness, and weak mechanical strength. Among all the known ultra-thin films, our nanofilm is the strongest and highly transparent, while being thin and porous at the same time. With such properties, the nanofilms can be used in flexible display devices, artificial skins and wearable devices, flexible ultrathin batteries, high-energy-density capacitors, omni-directional anti-reflection and self-cleaning films for solar panels, nanofiltration, etc.

Benefits

- Ultra-thin.
- Free-standing and self-supporting.
- High transparency.
- High mechanical strength.
- High gas permeability.
- Tunable porous properties.

Figures




100
80
60
40
20
0
Transmittance (%)
95.4%
Transmittance=98.8%
UV Range
Visible Light
IR Range
Ultrathin film
Glass slide
200
400
600
800
1000
1200
Wavelength (nm)