Robust Nanoparticle-containing Coatings for Anti-glare and Anti-fogging Applications
Technology #12230

Applications
Nanostructured materials, such as coatings containing nanoparticles, have attracted much attention in the last two decades. Their applications include anti-reflection, anti-fogging, superhydrophobic and anti-bacterial coatings. This technology might be applied toward specific commercial endeavors, such as the production of car windshields, building windows, and anti-fogging articles such as swim, ski and laboratory goggles.

Problem Addressed
Although there are numerous methods to fabricate nanoparticle/polymer composite materials cheaply and scalably, these nanostructures are characteristically mechanically weak. High temperature treatments, UV treatments, plasma treatments and chemical treatments have been proposed to improve the mechanical properties of nanostructure material; however, these treatments are often very hazardous and can only be applied on durable substrates such as glass, steel and silicon wafers. This does not address the commercial interest in coating flexible, heat-sensitive thermoplastics (e.g., for manufacturing car windshields and anti-fogging apparel).

Technology
The inventors have developed a low-temperature, cheap, and simple method to render nanostructures mechanically robust. Superheated steam is used to improve the mechanical properties of polyelectrolyte multilayers of nanoparticles. Incorporated nanoparticles include silica, with sizes range from 7nm to 50 nm. Polymeric layers of charged polymers, such as polyallylamine hydrochloride, may be used between nanoparticle layers. Hydrothermal treatment is performed using steam at 120 °C and 20 psi in an autoclave for up to 8 hours.

Small particles are much more soluble due to their small radii of curvature. The steam treatment is thought to dissolve parts of the nanoparticles and redistribute monomeric or oligomeric units at points of contact between the nanoparticles, forming interparticle bridges and providing stability. In addition to improving mechanical robustness, this hydrothermal treatment can also be used to generate surface patterns via self-assembly. Creating these surface textures on substrates such as glass would produce a material which would virtually eliminate reflections and deflect water droplets entirely, creating a robust anti-glare and anti-fogging coating.

Advantages
- Cheap, reliable and scalable fabrication technique
- Achieves virtually entirely glare-free and water-resistant coatings for many commercial applications
Categories For This Invention:

Materials
Micro & Nanotech
Nanomaterials

Intellectual Property:

Superhydrophilic coatings
Issued US Patent
Nanoparticle coatings and methods of making
Issued US Patent
7,842,352
Superhydrophilic coatings
US Patent Pending

Inventors:

Robert Cohen
Michael Rubner
Zekierya Gemici

Publications:

Through A Glass, Clearly
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2012
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2005

External Links:

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http://cohengroup.mit.edu
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