TECHNOLOGY

Highly Concentrated Water Soluble Carbon Nanotube Ink

OVERVIEW

Background

Carbon nanotubes are cylindrical nanostructured allotropes of carbon with unique properties. These carbon molecules have been extensively exploited for a variety of applications owing to their exceptional mechanical robustness, thermal conductivity, electronic transport and optical photoluminescence properties. One of its versatile applications is in the form of carbon nanotube ink, where carbon nanotubes are used in ink to print on paper and plastic surfaces. However, carbon nanotubes are difficult to manipulate and, have a propensity to aggregate and resist dispersion. Therefore, there is need for an easily dispersible carbon nanotube ink.

Innovative Technology

Researchers at the University of Maryland, College Park have developed a water soluble ink containing high concentrations of individually dispersed single-walled carbon nanotubes. This technology involves the introduction of an additive that enhances the viscosity of the solvent and decreases the free movement of carbon nanotubes relative to surfactant molecules. This effectively provides the surfactants present in the ink more time to surround and encapsulate the nanotubes during sonication, increasing the efficiency of sonication-induced dispersion. This process enables the carbon nanotubes to be individually dispersed and retain their unique properties.

Advantages

1. Aqueous solutions of individually-dispersed single-walled carbon nanotubes have been prepared using the novel additive as a co-dispersant to concentration in the g.L range. The highest achieved concentration is 3.35 g/L, but much higher concentrations are possible.
2. This novel ink product is prepared in high enough concentrations to achieve the highest contrast ratio possible (almost “truly black”) compared to other inks on the same substrate.

Applications

1. Ultra-high contrast ink: Using carbon nanotube ink prepared in high enough concentrations with the above method will allow for highest contrast ratio possible compared to other inks.
2. Conductive Inks: This novel ink has high concentrations of carbon nanotube solutions, some of which have high electrical conductivity, which is ideal for the conductive coatings that are important for the upcoming flexible electronics industry.
3. Transitive Inks (for Thin Film Transistors or TFTs): Certain species of carbon nanotubes are semiconductors. However, their properties are not discernable when they are generated along with a mixture of other carbon nanotube species. This novel ink allows the carbon nanotubes to be individually dispersed and retain their semiconductor properties when the ink is dry.
4. Document Security: The optical properties of nanotubes are intact due to their individually dispersed states. The unique photoluminescence properties in the near infra-red (NIR) spectral region can be used as document signatures or authentication marks. These features could be pre-built into the paper as a watermark or printed on the paper as an ink.

IP Status: Patent Pending
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Additional Information

INSTITUTION

University of Maryland, College Park

PATENT STATUS

Patent(s) pending

LICENSE STATUS

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CATEGORIES

- Nanotechnology + Nanoparticles + Nanomaterials

EXTERNAL RESOURCES

- US Patent 8,803,094

LS-2011-041