Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

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Inventors

Alexandra Ros

Mohammad Rabbani

Christoph Schmidt

Contact

Shen Yan
shen.yan@skysonginnovations.com

Dielectrophoretic Length-Selective Separation of Single-Walled Carbon Nanotubes

-Background Single-walled carbon nanotubes (SWNTs) possess unique physical, optical, and electrical properties with great potential for future nanoscale device applications. Common synthesis procedures yield SWNTs with large length polydispersity and varying chirality. Electrical and optical applications of SWNTs often require specific lengths, but preparation of SWNTs with desired length remains a challenge. Invention Description Researchers at Arizona State University and Duke University have developed an insulator-based dielectrophoresis (iDEP) method for fractionating SWNTs by length. With iDEP, SWNTs are subject to a nonuniform electric field, resulting in induced dipole moments that cause the SWNTs to be attracted to or repelled from regions of high electric field strength. Semiconducting SWNTs of varying length suspended with sodium deoxycholate (NaDOC) show unique dielectrophoretic properties at low frequencies (<1 kHz) that were exploited using an iDEP-based microfluidic constriction sorter device for length-based sorting. Specific migration directions in the constriction sorter were induced for long SWNTs (≥1000 nm) with negative dielectrophoretic properties compared to short (≤300 nm) SWNTs with positive dielectrophoretic properties. Potential Applications • Nanoscale electronics • Biosensors • Biological transporters Benefits and Advantages • Over 90% sorting efficiencies for long (≥ 1000 nm) and short (≤ 300 nm) SWNTs • Capable of sorting SWNTs in continuous mode which is advantageous for applications with larger quantities of SWNTs • Confers known iDEP advantages including simple fabrication and low cost Related Publication: Length-Selective Dielectrophoretic Manipulation of Single-Walled Carbon NanotubesFaculty Profile of Professor Alexandra Ros