One-pot Extraction of Right- and Left-handed Semiconducting Single-Walled Carbon Nanotube Enantiomers Using Fluorene-Binaphthol Chiral Copolymers

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A family of single-walled carbon nanotubes (SWNTs) has unique electronic, photophysical, mechanical and thermal properties. Synthesized SWNTs are mixtures of right- and left-handed helicity and their separation is an essential topic in nanocarbon science. Here, we report the separation of right- and left-handed ***semiconducting*** SWNTs from as-produced SWNTs.

Polyfluorene-based copolymers are intensively focused due to their highly specific sorting ability toward semiconducting SWNTs.[1,2] We have previously demonstrated a rational method for the selective recognition and solubilization of specific chirality of (*n*,*m*)SWNTs with a series of systematically designed and synthesized fluorene-based copolymers.[3]

Our strategy for this goal is simple: we designed copolymers composed of polyfluorene and chiral bulky moieties because polyfluorenes with long alkyl-chains are known to dissolve only semiconducting SWNTs and chiral binaphthol is a so-called BINAP family that possesses a powerful enantiomer sorting capability. We here demonstrate, fort the first time, a method for the

In this study, we synthesized 12 copolymers, (9,9-dioctylfluorene-2,7-diyl)x((R)- or (S)- o-2,2'-dimethoxy-1,1'-binaphthalen-6,6-diyl)y, where x and y are copolymer composition ratios. We found that, by a simple one-pot sonication method, the copolymers are able to extract either right- or left-handed semiconducting SWNT enantiomers with (6,5)- and (7,5)-enriched chirality.

Moreover, molecular mechanics simulations reveal a cooperative effect between the degree of chirality and copolymer conformation to be responsible for these distinct characteristics of the extractions.

This is the first example describing the rational design and synthesis of novel compounds for the recognition and simple sorting of right- and left-handed ***semiconducting*** SWNTs with a specific chirality.

The essential concepts of this study will accelerate molecular solutions for enantioselective SWNT sorting of selected chiralities.

References

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