

Structure-Controlled Synthesis of Single-Walled Carbon Nanotubes Using Intermetallic Compound Catalysts

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Single-walled carbon nanotubes (SWNTs) present structure-determined outstanding properties and SWNTs with a single (n, m) type are needed in many advanced applications. However, the chirality-specific growth of SWNTs is always a great challenge. Carbon nanotubes and their caps or catalysts can all act as the structural templates to guide the formation of SWNTs with a specified chirality (Fig. 1)[1]. SWNT growth via a catalyzed chemical vapour deposition CVD process is normally more efficient and therefore of great interest. We developed a new family of catalyst, tungsten-based intermetallic nanocrystals, to grow SWNTs with specified chiral structures. Such intermetallic nanocrystals present unique structure and atomic arrangements, which are distinctly different from the normal alloy nanoparticles or simple metal nanocrystals, therefore can act as the template to grow SWNTs with designed (n, m) structures. Using W_6Co_7 catalysts, we realized the selective growth of (12, 6)[2], (16, 0)[3], (14, 4) and other chiralities. By the cooperation of thermodynamic and kinetic factors, SWNTs with high chirality purity can be obtained (Fig. 2)[1].

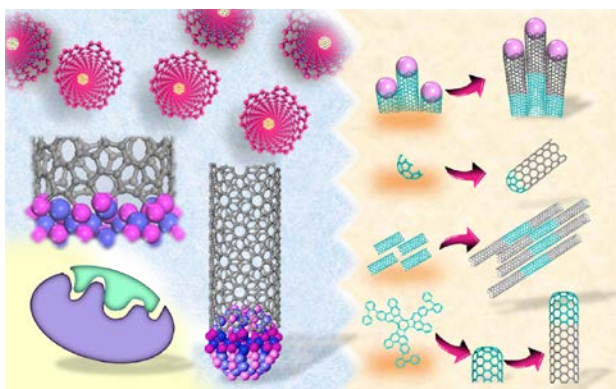


Fig. 1. Summary of the strategies for chirality-specific growth of SWNTs

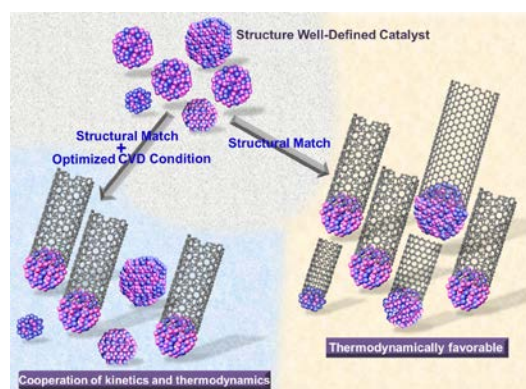


Fig. 2. Schematic illustration of the cooperative functions of thermodynamics and growth kinetics in Chirality-specific growth of SWNTs

Acknowledgement.

This research is financially supported by the NSFC (Projects 21125103, 91333105, and 21321001)

References

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