IBS Center for Multidimensional Carbon Materials

Tuesday Colloquium

Prof. Amsharov KONSTANTIN

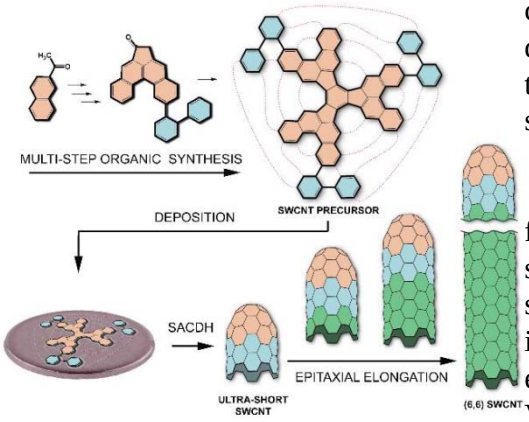
Department of Chemistry and Pharmacy
University of Erlangen-Nuremberg
konstantin.amsharov@fau.de

Rational Synthesis of Chirality-Pure Single Walled Carbon Nanotube

JUNE 13, TUE
2 PM

Bldg. 101
Seminar room on the 1st floor

Over the last decade, Single-Walled Carbon Nanotubes (SWCNTs) have attracted tremendous attention from almost all areas of science because of their extraordinary chemical and physical properties. The diversity in electronic properties of SWCNTs which vary from semi-conducting to metallic strongly depends on the atomic structure or chirality which is uniquely determined the tube connectivity by the pair of chiral index (n,m). The ability to tune the band gap over a rather wide range together with extra high chemical, mechanical and thermo- stability makes SWCNTs very promising candidates for many potential applications. However, the widespread use of SWCNTs has remained elusive due to a lack of efficient production techniques of chirality-pure samples. Although significant efforts have been made in selective SWCNT syntheses, no efficient pathway to truly single-chirality SWCNTs was found. Previously we have shown that specially designed polycyclic aromatic hydrocarbons (PAHs) can be quantitatively converted to the "preprogrammed" carbon nanostructure, such as buckybowls and fullerenes by surface assisted cyclodehydrogenation (SACDH), and have further demonstrated that the approach can be extended to the fabrication of CNT end-caps and even ultra-short singly-capped nanotubes bearing several CNT segments. The tubes obtained by this route are already bonded to the metal and can be used directly for the SWCNT fabrication on the same metal surface. Finally we have demonstrated that CNT seeds are active in tube growth initiation and can be indeed grown to isomerically pure SWCNTs exclusively by epitaxial elongation under Chemical Vapor Deposition (CVD) condition (Figure 1).



Our finding shows that the uncontrolled CNT nucleation can be avoided and an isomerically pure and defect free SWCNTs can be effectively fabricated in bulk.[3] Based on this discovery a one-pot synthesis strategy appears to be very attractive for the preparative synthesis of chirality pure SWCNTs. Since virtually all types of SWCNTs can be grown on metal catalyst surfaces by common CVD approaches, it seems to be highly realistic to extend the presented strategy for synthesis of SWCNTs with various possible chiralities.