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## Preparation and evaluation of new uranyl imprinted polymerelectrode sensor for uranyl ion based on uranyl–carboxybezotriazole complex in PVC matrix membrane

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In this study a new uranyl selective electrochemical sensors were prepared by using uranyl ionicimprinted polymer (IIP). The IIP was prepared by thermal polymerization using acrylic acid as a monomer,ethylene glycol dimethacrylate as a cross linking and a benzoyl peroxide as an initiator. Uranyl–carboxybenzotriazol (UO2–CBT) complex was used as an active material on the prepared polymer. Several uranyl electrodes were constructed by using different masses of polyvinyl chloride (PVC) matrix. Electrode parameters including slopes, working concentrations, pH, and interferences were evaluated. The electrodes exhibit a Nernstian response with slopes of 23.6 and 28.1 mV/decade for graphite uranylelectrode and liquid uranyl electrode, respectively, over a wide range of concentration from 3 × 10−6 to 6 × 10−2 M and a detection limit of 1 × 10−6 M. It can be used in the pH range of 4.3–10.5 with a responsetime of less than 60 s. The effect of ions interferences on the electrode response were evaluated. The IIP and nonimprinted polymer membranes were char-acterized by Fourier Transform Infrared Spectroscopy and Scanning Electron microscopy. The concentrations of uranyl ion in the prepared synthetic solutions determined by the standard addition method and the results were satisfactory with errors less than 7%. Finally, the prepared graphite UO2-IIP sensor was tested to determine the uranyl ions concentrations in a real environmentalwater sample by standard addition method. The developed electrode was found to be fast, sensitive and reliable indicated its potential use in measuring the uranly ion concentration in the field.

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## Synthesis and applications of kilometers of continuous macroscopic fibres with controlled type of carbon nanotubes

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We report on the synthesis of kilometres of continuous macroscopic fibers made up of carbon nanotubes (CNT) of controlled number of layers, ranging from singlewalled to multiwalled, tailored by the addition of sulfur as a catalyst promoter during chemical vapor deposition in the direct fiber spinning process. The progressive transition from single-walled through collapsed double-walled to multiwalled is clearly seen by an upshift in the 2D (G') band and by other Raman spectra features. The increase in number of CNT layers and inner diameter results in a higher fibre macroscopic linear density and greater reaction yield (up to 9%). Through a combination of multiscale characterization techniques (X-ray photoelectron spectroscopy, organic elemental analysis, high resolution transmission electron microscopy, thermogravimetric analysis, and synchrotron XRD) we establish the composition of the catalyst particles and position in the isothermal section of the C–Fe–S ternary diagram at 1400°C. This helps explain the unusually low proportion of active catalyst particles in the direct spinning process (<0.1%) and the role of S in limiting C diffusion and resulting in catalyst particles not being in thermodynamic equilibrium with solid carbon, therefore producing graphitic edge growth instead of encapsulation. The increase in CNT layers is a consequence of particle coarsening and the ability of larger catalyst particles to accommodate more layers for the same composition. We further present the distribution of CNT chiralities obtained from ED, Raman spectroscopy and Emission spectra and discuss these findings in the context of the current screw dislocation growth model accepted in the field. Finally, we show the application of basic polymer fibre spinning principles to produce highly oriented CNT fibres by reducing entanglements in the gas phase through CNT dilution. The resulting fibres have tensile properties superior to those of Kevlar, high electrical conductivity and a very large surface area. The exploitation of these properties in sensors, supercapacitors and other devices is briefly demonstrated.

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