Novel Applications of Rosette Nanotubes

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In today's society, nanomaterials are widely used beginning with our daily life all the way to highly-specialized machines. Such materials measure in the range of approximately 1-100 nanometers. These dimensions can be classified into three categories: a) 0-dimension nanomaterial (0D), b) 1-dimension nanomaterial and c) 2-dimension one (2D). Materials of 0D are measured on the nanoscale, such as, quantum dots and nanoparticles. The 1D nanomaterials are above the nanoscale, such as nanotube and nanofiber. The 2D nanomaterials that are made up of two dimensions are not confined to the nanoscale, as with graphene. Because of their small size, stability and chemically modifiable physical properties, nanomaterials have a wide range of uses, such as: catalysts, electro-devices, biological dyes, and as materials for delivery in the areas of bio-medical engineering and tissue engineering.[1] In biological area, nanotubes have become one of the most promising classes of materials also have the potential for successful use in tissue engineering.[2,3]

A nanotube is made up of a hollow interior, which enables the encapsulation of small molecules, such as a pharmaceutically active molecule. Another example for nanotubes would be self-assembled peptides, which contain short chains of amino acid monomers linked by peptide bonds.[4,6] Numerous experiments have shown that that such self-organized scaffolds can be used for the growth of cells in the area of tissue engineering, the drug delivery and gene therapy.[5] However, the instability and the difficulty of manipulation of such structures into long tubes restrict self-assembly peptides from being high quality biomaterials.[4]

Rosette nanotubes are a kind of materials with structure based on hydrogen bonds and can self-assemble into nanotube. There is a hydrophobic base unit possessing the Watson-Crick pairing. The spatial arrangement of these arrays let them to form a six-membered supermacrocycle.[7] Compared with self-assembled peptides, the 18 H-bonds in one cycle of rosette nanotubes and pi-pi stacking between layers makes it more stable. And numerous statistics show that such tubes are also bio-friendly which can be used as biomaterials. Rosette nanotubes also have the property that their size and dimension at the nanoscale level can be precisely controlled that can be turned into a variety of materials. This property enables a wide array of applications such as drug delivery[8], tissue engineering[9] and manufacturing highly specialized. For instance, it can encapsulate hydrophobic drug dexamethasone (DEX) as drug delivery material; combine with nanocrystalline hydroxyapatite (HA) on titanium as implant material; nucleate nearly monodisperse gold nanoparticals (AuNPs) to enhance the signal of Raman Spectrum. What's more, the some groups of rosette nanotube may be

functionalized and them they will change into muti-layer nanotube, which is useful in making biosensor.

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