PEPTIDE-BASED NANOTUBES FOR THE NON-INVASIVE DETECTION OF BIOMOLECULE SECRETION

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This study focuses on the use of peptide nanotubes as biocompatible substrates for cellular growth and proliferation as well as biosensors. A broad range of peptides that have been shown to form stable nanowires or nanotubes are based on amyloid proteins attributed to diseases such as Alzheimer’s and Type II diabetes. We have examined the ability to sublime different peptides and the subsequent deposition of peptide nanotubes and nanowires using Plasma Enhanced Chemical Vapor Deposition (PECVD). A custom-built vacuum chamber was used for the deposition of aromatic dipeptide monomers, such as dityrosine and tryptophan-tyrosine. Specific discharge parameters such as input power, chamber pressure, flow rate of argon gas, substrate position, and the lifetime of the plasma species were varied to help understand the range of physical and chemical properties of the peptide nanostructures such as their morphology. Plasma used in the PECVD process allows control over the composition of the nanotube growth imparting unique surface properties without modifying the bulk material properties of the substrate. The vertical arrays of nanotubes were studied as a substrate for cellular growth in order to understand the effect of morphology on the cells. By understanding the interactions between these tubes and somatic cells, we will understand how to utilize the tubes as the key component in a biological sensor. With this understanding, the sensor will be designed elucidate the properties of cellular communication that still evade us using conventional methods of detection. Secretion of biomolecules from cells have been conventionally analyzed by biochemical assays which, only offer average measurements from a population of cells with low resolution and sensitivity. Preliminary quantum-chemical studies have also been performed to elucidate the structures and properties of dipeptides, the building block for the peptide nanotube formation. This study will provide insights for the subsequent self-assembly atomistic studies of peptide nanotubes.

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