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Nanotechnology-based Sensors for Detection of Environmental Pollution

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18 - Carbon nanotubes-based sensors to detect environmental contaminants

A. Kumaravel [1], S. Sathyamoorthi [2]

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Abstract

One of the most fascinating materials in the field of nanotechnology is carbon nanotubes (CNTs), which are one-dimensional structures made of carbon atoms arranged in a cylinder shape. CNTs exhibit outstanding mechanical, electrical, and thermal properties, which make them one of the most intriguing materials on the market today. As Iijima looked for new carbon structures in the deposit that form during the electric-arc evaporation process and produce fullerene soot, he discovered CNTs. CNTs are hollow tubes that are formed when graphene sheets are rolled into cylinders and interconnected with hexagonal lattices, like graphite. According to their structure, CNTs are classified into two major categories: single-walled CNTs (SWCNTs) and multiwalled CNTs (MWCNTs). CNTs have unique properties because of the hexagonal lattice which is rolled into a cylindrical shape. A SWCNT is composed of one layer of carbon atoms, whereas a MWCNT is made up of several concentric layers of graphene stacked one on top of another, much like a Russian nesting doll. As a result of their exceptional mechanical strength, CNTs have applications in structural materials, such as composite reinforcements. They possess tensile strengths several times greater than steel and are significantly lighter, which makes them an excellent candidate for structural materials. Thermal conductivity of CNTs is excellent, surpassing that of most conventional materials. They are thus ideal for thermal management applications, such as heat sinks and thermal interfaces.