Chapter 1
Introduction

ABSTRACT

Nanotechnology development was initially "pushed" by fundamental knowledge (nanoscience and nano engineering) and the long-term promise of its transformative power. For this reason, we have done the preparation and governance of nanotechnology differently. This chapter describes the importance of the new nanotechnology for solid dielectric materials in our life. The main definitions of nanotechnology and historical background of nanotechnology materials are obvious. For nano, research policies have been motivated by long-term vision rather than short-term economic and political decisions. So, this chapter contains the concepts of nanodielectrics and nanofluids development. The purpose of present work is presented in this chapter.

The field of nanotechnology is a standout amongst the vast majority of prevalent zones to present innovative work on the whole specialized foul orders. This clearly incorporates dielectric science and engineering. Furthermore, in this field, the investigations disguise an expansive extent about topics. This might incorporate microelectronics that are concerned with illustration of the discriminating measurement scale, for up to date gadgets are right away beneath 100 nm. Other territories incorporate dielectric-based biomaterials, nanoparticle pill delivery, mini emulsion particles, power module cathode dielectric bound catalysts, layer-by-layer self-amassed dielectric films, electro spun nanofibers, engraving lithography and dielectric blends.

Nanocomposites category is the materials to which nanoparticles are added during the manufacture of those materials, and as a result, the nanomaterials show great improvement in its properties. For example, adding carbon nanotubes will change the properties of the electrical and thermal conductivity of the material. The addition of other types of nanoparticles may improve the optical and electrical insulation properties, as well as mechanical properties, such as hardness and strength. The volume ratio of the added nanoparticles must be very low (in the range of 0.5% to 5%) due to the fact that the ratio between the surface area to the volume of the nanoparticles is high. Furthermore, considerably in the field for nanocomposites, numerous different topics exist including composite reinforcement, obstruction properties, fire resistance, electro-optical properties, cosmic applications and bactericidal properties.

DOI: 10.4018/978-1-7998-3829-6.ch001

Nanotechnology is profoundly inserted in the configuration for propelled gadgets to electronic as optoelectronic provisions. The dimensional scale for electronic units needs to currently enter the nano-range. The utility from claiming dielectric-based nanocomposites over these zones is a very much different directing, including a significant number of possibility provisions and sorts for nanocomposites. Person-particular nanocomposite sort which has received significant enthusiasm includes conjugated dielectrics and carbon nanotubes. A later survey about this region has indicated a reiteration for possibility requisitions including photovoltaic (PV) phones and photodiodes, super-capacitors, sensors, printable conductors, light emitting diodes (LEDs), in addition to field impact transistors (Baibarac & Gomez-Romero, 2006). Additionally, the vast majority publicized requisition for dielectric nanocomposites might have been used for claiming exfoliated clay support from claiming TPO (thermoplastic polyolefin). Obviously, a lot of people have used more provisions directing, including exfoliated clay reinforcement, however, a number of these have not been publicized (Baughman, 2002; Moniruzzaman & Winey, 2006).

1.1 NANOMATERIALS AND APPLICATIONS

Nanomaterials take many forms; each with a structure, properties and a measure of its diameter and length, and each of them has distinctive uses as well. Nanomaterials can be classified according to the form of Quantum Dots category. This category is a three-dimensional semiconductor nanostructure ranging between 2 and 10 nanometers, and this corresponds to 10 - 50 atoms in a single diameter and 100 - 100,000 atoms in a single quantum point size, when the diameter of the quantum point is equal to 10 nanometers. Fullerene category was discovered in 1985 and it is another strange nanoscale of carbon, where a-60-carbon atom molecule has a symbol of 60C. A fullerene globular molecule is like spotted soccer, as shown in the figure below. Various applications have appeared for each of these compounds, including 60C3K and 60C2RbCs which have shown super conductivity. Moreover, other forms have been discovered, such as conical, tubular and spherical fluorines. Nano balls category is one of the most important carbon nanotubes that belongs to the 60C class of fluorines, but they slightly differ in composition, as they are multi-shells and they are also empty of center. The nanoballs have no gaps on their surface, and because of their composition, they look like onions. Scientists have called them “onions”, and the diameter of a single ball may reach 500 nanometers or more. Nanoparticles (nanoparticles) category is new to use. These particles were in manufactured or natural materials since ancient times. Nanoparticles can be defined as microscopic atomic or molecular assemblies which range from few atoms (a molecule) to million atoms, and they are almost spherically bound together with radius less than 100 nanometers. When the size of the nanoparticle reaches the nanoscale in one dimension, it is called a quantum well, but when its nanoscale is in two dimensions, it is called a quantum wire. When the quantum wire has 3 dimensions, it is called Quantum dots. Here, it is indicated that the change in the nanoscale dimensions of the three aforementioned structures will affect their electronic properties, which leads to a significant change in the optical properties of the nanostructures. Recently, nanoparticles have been made from ferrite, dielectric, semiconductor and hybrid formulations (such as encapsulated nanoparticles), as well as from models of nanoparticles of a semi-solid nature. Copper nanoparticles (less than 50 nm) are of high rigidity and are not malleable or withdrawable, unlike ordinary copper particles which can be folded, knocked and pulled. Nanotubes category is a slice that folds in a cylindrical shape; the end of the tube is often open and the other is closed in a semicircle. They are made from organic materials (carbon) or