Chapter 28
Nanocomposite for Surface Coating

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ABSTRACT

This chapter is a brief overview of the basic concepts involved in a nanocomposites used for surface coating. Nanotechnology is modernizing the world of materials. It shows elevated impact in developing an innovative generation of composites with superior functionality and a broad choice of applications. The information on privilege, depiction, and applications helps researchers in consideration and utilizing the particular chemical and material principles underlying these cutting-edge nanocomposites. Through the natural materials and polymers such as carbohydrates, proteins, and lipids, nature makes strong nanocomposites such as bones, shells, and wood. The study of carbon nanotubes has opened absolutely new windows for the development of polymer matrix composites with novel properties and applications. To date, numerous hard coatings based on nanocomposites have been effectively developed and commercialized for business applications. This chapter aims to provide an introduction to the applications of nanocomposite thin films and coatings will push the technology towards new perspectives.

INTRODUCTION

A nanocomposite is a matrix to which nanoparticles have been added to develop a fastidious properties of the material. Nanocomposites are a fissure of composites that take benefit of exclusive materials properties on the small scale. A nanocomposite is a multiphase solid material consisting one, two or three dimensions of less than 100 nm (Ajayan *et al.,* 2003). The nano-composite material has expanded appreciably to cover a large variety of systems such as 1-dimensional, 2-dimensional, 3-dimensional and vague materials, made of noticeably unlike components and mixed at the nanometer scale. Nanocomposites are materials that integrate nanosized particles into a matrix of customary material. The Inclusion of the nanoparticles is a sweeping improvement in properties that can include mechanical strength, toughness and electrical or thermal conductivity. In the liberal sense this definition can comprise porous media, colloids, gels and copolymers, but is more frequently in use to mean the solid combination of a bulk matrix and nano-dimensional phases conflicting in properties due to divergence in structure and chemistry. Nanocomposites are established in nature, for example in the structure of the abalone shell and bone(Jose *et al.,* 1996). The make use of nanoparticle-rich materials long predates the considering physical and chemical

DOI: 10.4018/978-1-4666-6363-3.ch028

nature of these materials. The properties of the nanocomposite like mechanical, electrical, thermal, optical, electrochemical, catalytic will vary noticeably from that of the component materials. It also offers the possibility to combine diverse properties which are impossible within a single material, e.g. flexible mechanical properties and superconducting properties. The familiar class of nanocomposite organic, inorganic materials is a hasty growing area of research. The properties of nano-composite materials depend not only on the properties of their individual parents but also on their morphology and interfacial characteristics. This speedily growing field is generating many thrilling new materials with novel properties. The inorganic components can be 3D framework systems e.g zeolites, 2D layered materials such as clays, metal oxides, metal phosphates, chalcogenides, and even 1D and zero-dimensional materials like $(Mo_3Se_3\text{-})_n$ chains and clusters. Nanocomposites assure new applications in numerous fields such as mechanically reinforced lightweight components, non-linear optics, battery cathodes and ionics, nano-wires, sensors and other systems. The ordinary class of organic and inorganic nanocomposites may also be of significance to issues of bio-ceramics and biomineralization in which *in-situ* development and polymerization of biopolymer and inorganic matrix is taking place. In contrast to metallic and ceramic materials, composites are relatively cheap, can easily be processed, as they need less energy for production and shaping and have a variety of fields of application in textiles, electromagnetic shielding, coatings, automotive parts, electronic and household appliances etc. There is an opportunity of building planned arrays of nanoparticles in the polymer matrix. A numeral of possibilities also subsists to manufacture the nanocomposite circuit boards. An even more gorgeous method exists to exploit polymer nanocomposites for neural networks applications. Another gifted area of development is optoelectronics and optical computing. The single domain nature and super paramagnetic behavior of nanoparticles containing ferromagnetic metals could be possibly utilized for magneto-optical storage media manufacturing. Of newer attention is the exercise of nanocomposite technology, which provides improved thermal and mechanical robustness, which occasionally brings multifunctional concert to the composite. Surface coatings symbolize an engineering solution to preserve the composite part, but newer research spotlighted on insertion of the barrier coating during composite fabrication so that the shelter is engineered to be a covalently bound component of the polymer rather than a post-fabrication add-on coating produced through painting or adhesive bonding (Walter,2000).

In the current work, the stress is put on present practices and future crazes for nanocomposite for surface coatings. This chapter will not be so meticulous as to cover all aspects of such coatings, but the main objective is to give a broad sense of what has so far been accomplished and where the field is going.

CLASSIFICATION OF NANOCOMPOSITES

There are principally two approaches of classification for nanocomposites. They are the organic and inorganic nanocomposites. So many labors are taken by the researcher to take supremacy over nanostructures by synthetic modes. The possessions of the nanocomposites not only depend upon the individual parent opus but also on their morphology and interfacial characteristic. In the categorization of the nanocomposites the inorganic components can be three dimensional structure systems such as zeolites; two dimensional layered materials such as clays, metal phosphates, metal oxides, chalcogenides and even one-dimensional and zero-dimensional materials, such as (Mo3Se3-)n, chains and clusters.