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Chapter-1

Introduction to Silver Nanomaterials

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1.1 Introduction

Nanotechnology is a cutting-edge, unique field of science that involves building structures from 1 to 100 nm particles. Nanomaterials exhibit fascinating physical, thermal, optoelectronic, catalytic, and magnetic properties. They relate large matter to molecular structures [1]. Small-grain ceramics bend more than large-grain ceramics at high temperatures. Nanostructured semiconductors have optical characteristics and are employed in solar cell windows. Nanostructured metal oxides are employed in sensors, supercapacitors, catalysis, and rechargeable automobile batteries [2–6]. Polymer nanocomposites with a high dielectric constant are photonic materials. Phase, size, and shape affect nanomaterials' characteristics and usage. The phase, shape, size, and dimensions of nanomaterials have been studied extensively [7]. "Silver nanoparticles" are nanoscale silver-containing compounds with increased activity. Researchers have constructed ellipses, spheres, flowers, rods, tubes, cubes, triangles, and stars. Silver nanotubes, nanorods, nanowires, nanoparticles, nanocubes, nanofibers, nanoprisms are examples. Physical, chemical, and biological techniques can generate nanostructured silver.

This chapter discusses silver nanomaterial varieties and uses. Here are some descriptions of silver nanoparticles.

1.2 Silver Nanoparticles:

Metal nanoparticles have been utilised in more sectors in recent years. Silver nanoparticles are well-known for their versatility. Smaller than 100 nm, silver nanoparticles have 20 to 15,000 atoms. Physical, chemical, and biological properties differ from bulk silver. Silver nanoparticle shape, size, and surface area affect light, heat, and catalysis. Consumer goods, medical gadgets, textiles, cosmetics, electronic and analytical equipment, catalysts, water disinfectants, food packaging, paints, etc. use silver nanoparticles. Silver nanoparticles destroy germs, have low electrical and thermal resistance, and a massive plasmon field. Silver nanoparticle production has increased due to higher demand (AgNPs). By 2025, roughly 900 tons more silver nanoparticles will be made each year than in 2009 [10, 12]. AgNPs were utilized to clean water, medical devices, and domestic appliances. Some textiles utilized them as disinfectants [13–15]. Cotton AgNPs killed E. coli [16]. AgNPs can be used in nanoscale sensors because of their