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In this article, we review the fundamental properties of several spherical and cylindrical, passive, and active coated nanoparticles (CNPs) with an emphasis on their potential for nanoantenna and nanoamplifier synthesis. For the spherical geometries, the nanoparticles are excited by an electric Hertzian dipole (EHD), which represents, e.g., a stimulated atom or molecule. The cylindrical nanoparticles are excited by a magnetic line source (MLS). In the active cases, gain is added to the core region of the particle. For simplicity, it is represented by a canonical, frequency-independent gain model. We demonstrate that specific CNPs can be designed to be resonant and well matched to their respective excitation sources. With active cores, these designs can lead to extremely large total radiated powers. For both configurations, insights into the effects of the nanoparticle material composition, source location, and orientation will be given on the basis of studying their near-field and power-flow density distributions, total radiated powers, and directivity properties.

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