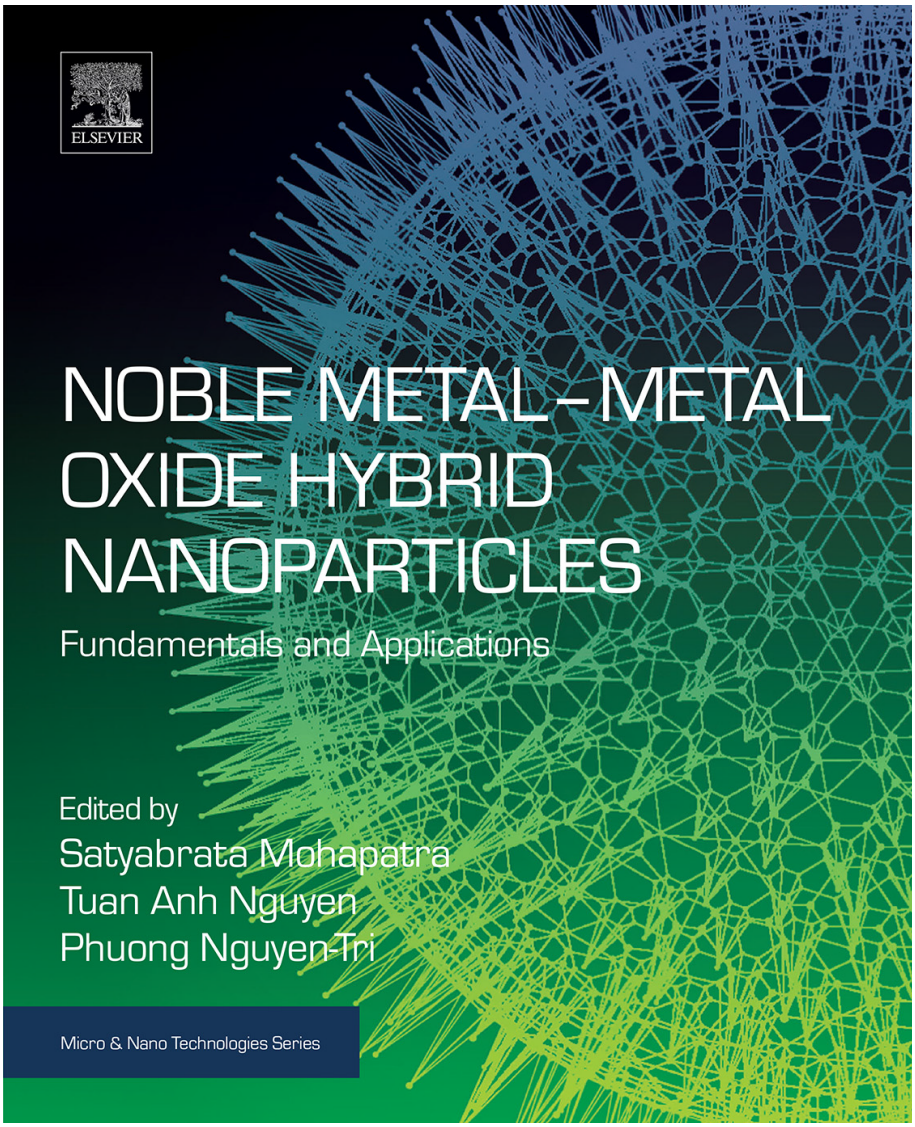
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# NOBLE METAL-METAL OXIDE HYBRID NANOPARTICLES

## Fundamentals and Applications

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CHAPTER

# 16

# Noble Metal–Manganese Oxide Hybrid Nanocatalysts

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## 16.1 INTRODUCTION

During the last three decades, with the advent of the art of nanomaterials synthesis, the design of hybrid assemblies by controlled miniaturization of two or more disparate materials containing two or more different functionalities represents a potential approach for achieving advanced materials that have become more and more indispensable to fulfill both scientific and technological perspectives [1–6]. Synthetic approaches offering high degree of control over composition and morphology with a wide range of material combinations have become an effective strategy for inducing new physicochemical properties and realizing multifunctionality governed by the synergistic effect among the individual components [7]. These hybrid assemblies exhibit new optical, electrical, magnetic, mechanical, chemical, thermodynamic, and catalytic properties that can be tuned by controlling their composition, size, shape, and organization at the nanoscale. The tunable properties, along with the chemical and biological accessibility, open up new opportunities to spread their interest in a diverse range of niche applications, such as ferrofluids, medical imaging, drug targeting and delivery, cancer therapy, separations, and catalysis [8].

An exponential growth of research activities has been seen in nanoscience and nanotechnology since the 1990s. When the size of the materials becomes smaller and smaller and shrink to the nanometer length scale, new physicochemical properties emerge inside the nanostructures. Manganese oxides are materials of considerable importance due to their remarkable diversity of atomic architectures that inspire newer technological applications [9]. When manganese oxides are allowed to interact with noble metal nanostructures

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