Application of Nanostructured Powders Synthesized by New Chemical Processes

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ABSTRACT

Research on nanomaterials in Korea has been fairly active in the past several years to develop new processes and apply them in industry. Various kinds of methods have been investigated to synthesize nanostructured powders and develop their consolidation processes and nanocrystalline bulk materials.

Recently, we have successfully produced various nanostructured powders by chemical synthesis methods. Nanoscale W based composite powders (WC-Co, W-Cu) and Cu-Al_2O_3 composite are synthesized by mechanochemical process (MCP) using metallic salt precursors. Fully densified W-Cu composite alloy is achieved without sintering activator. Non-agglomerated nanosized WC, Fe, Co, TiO_2 and it nanocomposite(WC-Co and Fe-Co etc.) are also synthesized by chemical vapor condensation (CVC) process using metal organic precursors such as tungsten hexacarbonyl($W(CO)_6$), iron pentacarbonyl($Fe(CO)_5$) and cobalt octacarbonyl($Co_2(CO_8)$). The synthesized TiO_2 powder consists of anatase and rutile phase with an average particle size about 20nm and 60 70nm, respectively. Fe nanoparticles with uniform dispersion are on the order of 5 to 13 nm in mean size and have core-shell structures. Co powders in CVCed WC-Co nanocomposite show intricate long-stand structure because of intrinsic magnetic properties of Co phase. The synthesized nanostructured WC-Co powders provide better sinterability and hardness of sintered material than those of the commercial submicron powder. Fe-Co alloyed nanocomposites shows also core–shell structure consisted of metallic cores and oxide shell. The mean particle size is about 5–25 nm. In this work, we will discuss the technical issues for application of new chemical methods for nanostructured powder materials.