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# Synthesis and Characterization of TiC-$Al_2O_3$ Nanoparticles

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## ABSTRACT

The effect of alumina nanoparticles on structural and mechanical properties of titanium carbide was investigated. The samples were prepared with different concentration of nano$Al_2O_3$ are (0, 2, 4 and 6) wt.% which were added to titanium and graphite. The results were explained that XRD was showed no reaction occurs between TiC and nano$Al_2O_3$. The mechanical properties (microhardness, compression strength and wear strength) were studied. The microhardness, compression strength and wear strength were increased at 2 and 4 wt.% nano$Al_2O_3$ then decease.

**KEYWORDS:** titanium carbide, nano$Al_2O_3$, compression strength, wear strength, microhardness.

## INTRODUCTION

Refractory compounds, mainly carbides of transition metals, has concerned a large deal of interest from the technical society because of excellent chemical and physical properties, for instance high melting temperature, electrical resistivity, great hardness, chemical inertness, superconducting, ….etc. [1]. These exclusive properties have made carbides mainly promising manufacturing materials for a broad range of engineering applications like in petroleum, electronics, high power, aerospace, chemical industry, high-temperature engineering and nuclear industry [2].The among important carbides is titanium carbide, TiC is a high temperature ceramic material widely used as abrasive [3], grinding wheels, cutting tools [4] and ball-bearing coatings [5]. At present, the use of nanosized powders as starting reagents and modifying agents to improve the product performance characteristics is of a great interest. Small amounts of nanosized powders added produce a rather positive influence on the material characteristics owing to their unique properties, large specific surface and small dimensions[6]. Alumina is one of the most important materials in the ceramic industry[7], because of its excellent mechanical properties, good chemical stability and high temperature characteristics[8].

Recently nanocrystalline $Al_2O_3$ powder has considerable potential for a wide range of applications including high strength materials, electronic ceramics, catalysts[9], biomaterial and reinforcements of metal-matrix composites[10]. Chengliang and Mingguang [68] studied the adding (TiN) nanoparticles to (TiC)based cermets. Results discovered that several added (TiN) nanoparticles fewer than (80 nm) could be entrapped inside (TiC) grains, while from (50 nm to100nm) dispersed at grain boundaries and created (intra/inter)type microstructure. Properties indicated that the material had top transverse rupture strength (TRS) and fracture toughness (KIC) at room temperature[11].The present paper reports the results of added nano$Al_2O_3$ with different weight percentages to TiC.

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