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The need for cutting tool materials with improved mechanical properties and chemical inertness capable of operating at high cutting speeds is becoming essential. Ceramic materials are the prime candidates to fulfill these requirements because of their excellent physical properties such as thermal stability, high hardness, and good corrosion resistance. Ceramic tools fabricated using the titanium carbide is characterized by their high thermal conductivity and low thermal expansion.

(TiC) is a ceramic material with many applications in key high technologies, including mechanical, chemical and microelectronic applications. TiC has also a high melting point, high hardness, high electrical conductivity, high chemical and thermal stability, high wear resistance, as well as high solvency for other carbides. It can be used as a substitute for tungsten carbide, a common machining material. Titanium carbide is also used in coated steel press tools, grinding wheels, wear-resistance coatings, high-temperature heat exchangers, magnetic recording heads, turbine engine seals and bulletproof vests. TiC and carbonitride are also utilized in the production of SiC-TiC, Si_3N_4-TiC, Al_2O_3-TiC and ZrO_2-Ti(C, N) composites [1], However, oxide mixed ceramics are characterized by their high brittleness. Titanium carbide has a tendency to oxidation at the temperature above 800 °C. This fact restricts the use of the mixed ceramics in case of high speed cutting processes. One of most widely used material for the ceramic cutting tool is alumina (Al_2O_3). The addition of hard secondary phases such as TiC whiskers, SiC, TiB_2, Ti(C, N), or ZrO_2 particles, to alumina matrix provides great improvement in mechanical properties [2–9], for example, the addition of TiC or TiB_2 particles to Al_2O_3 matrix improves the fracture toughness, the hardness, and the strength over those of monolithic Al_2O_3 and offers advantages to wear and fracture behavior when used as cutting tool materials [10, 11]. The addition of SiC whisker to Al_2O_3 matrix improves the fracture toughness and the thermal shock resistance of Al_2O_3 [2, 3, 5] and moreover offers advantages with respect to fracture behavior.

However, it is not easy to produce advanced materials without discovering new synthesis processes. One of the most recent and important techniques is known as self-propagating high temperature synthesis (SHS) or combustion synthesis, which is used mainly to produce advanced materials. This process utilizes the heat released from exothermic reaction to complete the reaction in a self-sustaining manner.

The Potential advantages of this process are simple reactor, rapid synthesis, self-heating, energy saving, self-purification due to enhanced impurity outgassing, synthesis of metastable phases and near-net shape fabrication. In addition, More than 300 kinds of advanced materials could be synthesized by SHS process, including intermetallics, silicides, carbides, borides, nitrides, sulfides, and hydrides. Advanced composites are reported to be synthesized by applying SHS process not only for solid-solid systems but also for gas-solid and/or liquid-solid systems. Furthermore it can be applied for shape memory alloys (NiTi), hydrogen storage alloys ($LaNi_5$, FeTi) and high temperature superconductors ($La_{1.85}Ba_{0.15}CuO_4$). Thus, it is now well established that SHS process can be of practical significance in producing novel solid materials and improving the characters of the conventional homogeneous materials through preparation of Functional Grade Materials (FGM). In addition to practical utility, the SHS process also creates fundamental interest because interesting and diverse phenomena such as steady planar propagation, pulsation, spinning, and repeated combustion have been observed for wave propagation in the solid compact.