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Effect of Pressure Load on the Physical Properties of ZTA-TiO2-Cr2O3

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Abstract
ZTA is considered as one of the most popular ceramic composites that are used for cutting tools due to their excellent properties. Consistent efforts should be expanded to achieve improvements in toughness and strength, and thus help them achieve a longer tool life. However, powder compaction process has been found to be a limiting factor in the production of a defect-free ceramic pellet where the green product often ruptures immediately after the compaction process or sintering process. This may be contributed by uneven distribution of pressure load, thus affecting the particles packing and properties of final product. As a solution, the present work aims to study the effect of different compaction pressure on the physical properties of ZTA-TiO2-Cr2O3 ceramic composite to establish a defect-free cutting insert. The samples were fabricated by solid state processing, subjected to pressure loads varied from 200 MPa-350MPa, followed by sintering at 1600°C for 1 hour. The sintered samples were characterized accordingly. The results showed significant enhancement in density and hardness with increasing compaction pressure from 200 MPa to 300 MPa. On the other hand, further increment of pressure deteriorates the properties of the samples. These were due to the excessive external pressure which caused a very tight compaction in the mold, resulted in elastic expansion of the compact and sliding of particles as the pressure is removed. In conclusion, ZTA-TiO2-Cr2O3 subjected to 300 MPa compaction pressure showed the most optimal properties with the highest density (4.58 g/cm3) and hardness (2001 HV).

Author Keywords
density; pressure load; Vickers hardness; ZTA-TiO2-Cr2O3

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