International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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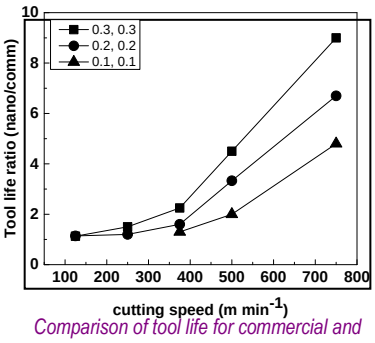
Alumina Based Cutting Tool Inserts by Spark Plasma Sintering

Overview

The addition of nanocrystalline ZrO_2 and TiCN to ultrafine Al_2O_3 and their consolidation by spark plasma sintering (SPS) yields good microstructure and better mechanical properties which enhance the performance of cutting tools made from them. The distribution of the nanoparticles depends on their overall concentration leading to proper densification. Maximum hardness (21 GPa) and indentation toughness (5.5 MPa m1/2) was obtained with 23 vol% nanoparticles, which was considered as the optimum composition. Cutting tool inserts were developed by SPS with the optimized composition and their machining performance was compared with commercial alumina based inserts. Increased toughness in the nanocomposite inserts reflects in the machining performance as the tool life improves drastically compared to that of the commercial inserts at high cutting speeds ≥ 500 m/min.

Key Features

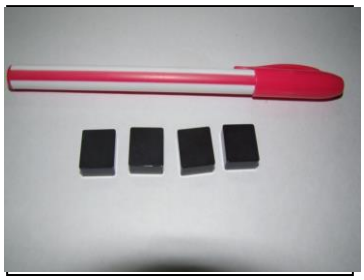
- Low processing temperature of 1150-1200°C
- Short processing times of 5-10 mins
- Full density achieved
- High hardness and indentation toughness in composites
- Increase in toughness manifests in increased tool life at high cutting speeds
- Tool life almost nine times higher than commercial inserts



Comparison of tool life for commercial and in-house developed tool inserts

Potential Applications

- Cutting tool inserts for machining hardened steels



Cutting tool inserts of configuration SNGN120408

Intellectual Property Development Indices (IPDI)

- Processing by SPS has been optimized in terms of mechanical properties
- Cutting performance evaluation at laboratory scale

Status	1	2	3	4	5	6	7	8	9	10

Major Publications

1. Dibyendu Chakravarty, G. Sundararajan 33, 2597-2607, 2013, Journal of the European Ceramic Society

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