ABSTRACT

Alumina ceramic cutting inserts made through powder metallurgy route, which are indexed in industrial catalogues in the middle of this century, though had enough compressive strength, hardness and chemical stability, but were inherently weak in tension, toughness and transverse rupture strength. During the last few years the improved manufacturing technology of ceramic tools has remarkably increased the strength, toughness and wear resistivity by control of composition, manufacturing processes and the finishing methods. These modern ceramic tools have found wide and economic application in production by machining of both cast iron and steel.

The principal aim of the present investigation is to develop commercially viable high performance ceramic cutting inserts for high productivity machining. The first phase of the research work was confined to synthesis and characterization of the starting materials like α-Al_2O_3, CaO and Y_2O_3 -doped partially stablized zirconia (PSZ) and processing of zirconia (PSZ) toughened alumina ceramic cutting tool by adding partially stabilized zirconia (Ca-PSZ, Y-PSZ) in alumina matrix in varying proportions.

In the second phase of this work, experimental evaluation of the overall performance of the ceramic cutting inserts have been carried out by machining C-15 steel at considerably

high cutting speed (220 to 450 m/min) and industrially large feed (0.24 mm/rev.) and depth of cut 1.5 mm under dry condition. Some of the inserts have been found to be successful in machining at speeds, 350 m/min. and still higher. Y-PSZ-alumina ceramics showed better results than Ca-PSZ-alumina cutting tools regarding wear resistance, tool life, high hot hardness and cutting force. One of the presently developed ceramic insert could machine relatively stronger macterial like C-50 steel quite successfully at speed as high as 450 m/min.