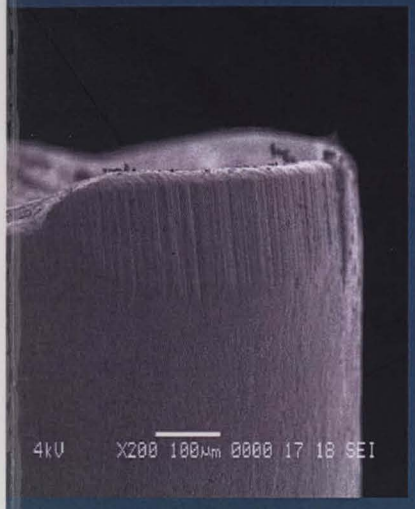

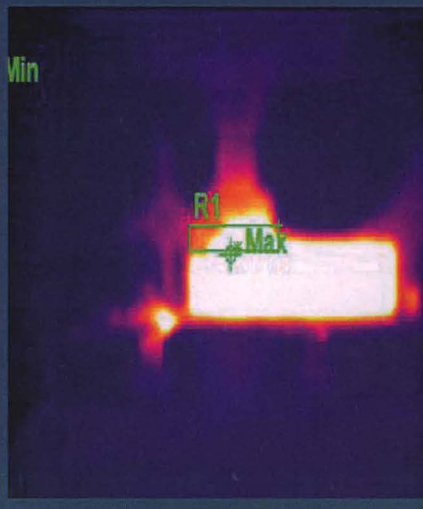

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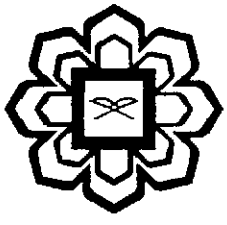

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Chapter 30

Surface Study when Finish Grinding Silicon using Resin Bonded Diamond Cup Wheel

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1. Introduction

Brittle materials are difficult to machine as they have high hardness and low toughness. In conventional grinding of hard and brittle materials, less ductile streaks are formed, thus resulting in 100% fractured surfaces that requiring more time on lapping and polishing [1]. This will increase the production cost and the manufacturing lead time in fabrication of brittle material such as silicon and glass.

To perform 100% ductile mode machining of brittle materials, machine tools with high accuracy servo mechanisms (resolution 1.25-10 nm), high loop stiffness, full flood coolant and a depth of cut less than 1μm must be used [1]. Examples of such machine tools are ultra precision machines for ultra precision grinding. Because these ultra precision machines tools and cutting tools manufactured to submicron tolerances are expensive, ductile mode machining has gained little attention world wide, although its application has been known by the industries. Research has proved that ductile mode machining can be carried out on less expensive and conventional machine tools [1].Therefore, in this paper aims to find the process parameters will facilitate ductile mode machining on hard and brittle silicon using conventional NC milling machine.

A material is brittle if when it is subjected to stress, it has little tendency to deform (or strain) before fracture. This fracture absorbs relatively little energy, even in materials of high strength. When used in materials science, it is generally applied to materials that fail in tension rather than shear, or when there is little or no evidence of plastic deformation before failure. When a material has reached the limit of its strength, it usually has the option of either deformation or fracture.

Hard and brittle materials typically represented by silicon (Si) in this work are difficult to machine but are significantly important materials in electronic and optical industries. Silicon constitutes 90% of all semi-conductor materials. Semiconductor materials and their processing are emerging technologies of the 21st century. Semiconductors are the bases for electronic devices such