ABSTRACT

The invention of new materials for advanced applications necessitates the need for higher dimensional and geometric accuracy. These materials are inherently more difficult to machine and grinding is the most acceptable abrasive machining process used for its finish.

With the advent of abrasive machining, grinding is the dependable process with high material removal rate. Parts can be produced to the required size and finish, economically which was difficult by other methods. Now grinding process permits heavy stock removal with a good finish on the same machine itself without changing wheels.

Many scientists have investigated the dissipation of heat in grinding and the resulting influence on the surface integrity of the work-piece. Under abusive grinding conditions the formation of Heat Affected Zone (HAZ) was observed which damages the ground surface of the hardened steels.

The main aim of this thesis is to make use of HEAT FLUX generated in grinding for the attainment of required hardness level at the surface, without deteriorating the surface of the work-piece.
In this present work a new heat treatment process called "Grind Hardening" has been introduced. In this work the grinding parameters are being optimized to induce fine martensitic phase transformation in the surface layers of steels as it is achieved by other surface strengthening processes. This process can be easily integrated into the production line, aiming economical advantages.

This thesis deals with the experimental studies, to achieve good surface finish with increased hardness at the surface and also considerable depth beneath surface by utilizing the in-process energy source developed during machining. Also to achieve residual stress of compressive nature which is an added advantage.

Experiments were carried out in cylindrical grinding machine for various steel materials by varying the number of passes, depth of cut and feed speed to optimize the in-process energy to achieve maximum hardness at the surface and to a considerable depth.

Surface integrity study has been carried out and the results are reported. It is found that there is considerable degree of improvement in hardness, surface finish to the required level and without any surface and subsurface flaws, such as microcracks, rehardening burn, temper burn, etc., There is also favourable residual stress produced in the work surface.