PARAMETRIC OPTIMIZATION OF SURFACE GRINDING WITH CRYOGENIC COOLANT

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ABSTRACT

Sustainable machining is becoming an emerging area in manufacturing because of economical and health problems caused by usage of cutting fluids. Among all the machining operations, an enormous amount of heat is produced during grinding process due to large contact area between work piece and grinding wheel. For controlling such high temperature during the operation, the use of coolant is very necessary. The presently used conventional coolants in almost all industries have some negative effects like environmental pollution due to boiling of cutting fluid, smoke, affecting the health of operator, difficulties in storage of cutting fluids. The surface quality of ground surfaces is also at stake if conventional coolants are used. An appropriate alternative to this problem is use of cryogenic coolant during machining which has been undertaken in the present work. In the present work, parametric optimization of surface grinding has been done by taking cryogenic coolant (liquid nitrogen) as a cooling medium and comparison has been done with dry and conventional coolant. The experiments were performed on precision surface grinder by considering three input parameters (cooling condition, depth of cut and longitudinal feed/table speed). Investigations have been done to check the influence of process parameters on surface roughness (μm), micro hardness (HV0.1) and specific energy (J/mm3). The process parameters were optimized using Minitab software based on Taguchi L9 orthogonal array. The analysis indicated that the cryogenic coolant proved to be best for improvements in surface roughness and micro hardness whereas dry condition better for specific energy consumption. The minimum surface roughness of 0.563 μm and maximum micro hardness of 665.33 HV0.1 obtained under cryogenic condition and minimum specific energy 1377.40 J/mm3 obtained under dry condition.