ABSTRACT

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The application of the grinding process is growing in the metal working industry and with this growth there is an increase in the amount of cutting fluid used to minimize the heat generated in this process. These fluids act by lubricating the wheel-workpiece interface and by conducting heat away and cooling the grinding area. Although the fluids possess the ability to improve the grinding process, on the other hand, they generate some problems; such as damage to the environment when disposed and to the operator's health during their use. Due to the growing need to adapt current safety standards regarding operators and environment, new combinations of wheel types and cutting fluids are being sought. As a result, the grinding process is being optimized by adopting grinding strategies that lead to a decrease in the energy expend during the cutting process, and its rapid dissipation out of the grinding zone. These procedures include the use of CBN wheels, which allow a larger amount of heat to be removed from cutting area through the tool. Therefore it is clear the necessity of a technological development of new cutting fluids with high lubrication ability and biodegradable characteristics. Based on this necessity this PhD project was proposed, which aims to evaluate the influence of different types of cutting fluids available in the market on the CBN wheel, by chemical and physical analyses. Also the development of alternative cutting fluid based vegetable oil, which have lubricant ability and is not aggressive to the environment. In order to evaluate if the CBN grains react with the water in soluble fluids, grinding tests were carried out using a low amount of water (approximately 50 liters) and also reaction was simulated in a chemical reactor under ideal conditions. CNC cylindrical grinding tests were performed to compare the different cutting fluids. Chemical and physical analyses, such as viscosity, pH, rust inhibitor and biodegradability characterized the new formulation. The mechanical performance of the new cutting fluid was evaluated through conventional surface grinder and compared with other grinding fluids existent in the market. The parameters used to compare the mechanical performance were the work piece roughness and the CBN wheel wear. Based on these experimental results, the following conclusions can be drawn: The CBN grains don't react with water under the evaluated grinding conditions, which indicates that soluble cutting fluid can be used in CBN grinding process. The proposed cutting fluid, when used in concentration of 21% gave results similar to the best commercial fluids and at the same time it accomplishes environment requirements. The soluble fluid based on sulfonate castor oil is easily biodegradable and is not aggressive to the environment

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