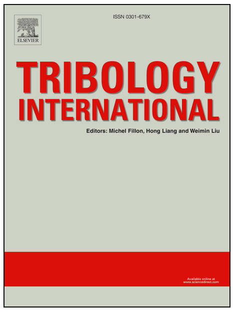

Effective application of scraper board in grinding

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EFFECTIVE APPLICATION OF SCRAPER BOARD IN GRINDING

Abstract: This experimental work is aimed at characterizing the effect of scraper board (SB) in reducing the rotating air layer around a grinding wheel and introducing the better method of application of scraper board and fluid delivery into the grinding zone. Zero pressure at the grinding zone is reported to achieve by placing the scraper board at an optimal location along the wheel periphery. The grinding ratio improved by 35.6% and 119%, surface roughness decreased by 36% and 54.2% while the requirement of specific energy is reduced by 50.8% and 57.3% when scraper board is positioned at the critical distance in comparison to the 57.5° position and no scraper board respectively.

Keywords: Grinding; fluid delivery; scraper board; critical region; grinding force; surface texture, grinding ratio; specific energy; grinding chip, ANOVA, regression model.

1 Introduction:

Grinding is a high speed and multi-tooth surface finishing process, associated with high energy requirement per unit volume of stock removal. In this process, the energy required for grinding is mostly converted to heat energy when grits come in contact with workpiece [1-3]. Malkin and others have observed that this heat gets distributed mainly into chips, workpiece and wheel [2, 3]. It is also reported that workpiece quality and productivity gets affected by the high temperature of grinding [4]. To reduce the detrimental effect of heat, coolant jet is supplied into the contact zone. It reduces the heat generation and increases the work quality [5]. But, as the wheel rotates, due to viscosity, the static air around also rotates along the wheel, obstructs the coolant jet and only 5 – 30% of supplied fluid enters into grinding zone [6, 7]. Guo and Malkin have indicated that nozzle velocity, the positioning of nozzle and porosity of wheel influence useful flow rate of grinding fluid through the grinding zone [7]. Earlier Han and Li and later on Mondal and others have observed the presence of this air reduces machining accuracy of the workpiece, enhances abrasion of grinding wheel and prevents the entry of grinding fluid into work-wheel interface [8, 9]. The rotating air becomes stronger and more turbulent with the increase of speed of the wheel [10]. Therefore, effective delivery of coolant into the wheel-work interface by reducing the consequence of impeding air around the wheel is important [11-13]. The present work is aimed at abolishing this obstructing air layer in order to improve the access of fluid into grinding zone and improve grinding performance successively.

Many experiments have been carried out to break this stagnant air boundary layer. Recently, with the application of pneumatic barrier 53% reduction of pressure of air boundary has been reported which reduces the wastage of grinding fluid and environmental pollution [14-15]. Catai et al. have employed aerodynamic baffle to reduce this hindering air layer. With this baffle, not only