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A REVIEW, EVALUATION AND COMPARISON OF CUTTING FLUID USED IN CNC LATHE MACHINING

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Abstract: *Cutting fluid are majorly used in machining process to reduce temperature, cutting forces and thus extends the tool life. Cutting fluid contain complex components, different ingredients some of which are toxic in nature. However due to this constant exposure to these fluids causes health hazards to the workers. Further chemical treatment is required cause of disposal of the cutting fluid on the machined material increases the cost. To make cutting fluid more benign, vegetable-based compounds are being used to replace the toxic ingredients of existing cutting fluid. This is done in different levels, i.e., either only the mineral oil or even the emulsifier is replaced by a vegetable alternatives.*

1. Introduction

Cutting fluid is a type of coolant and lubricant designed specifically for metalworking processes, such as machining and stamping. There are various kinds of cutting fluids, which include oils, oil-water emulsions, pastes, gels, aerosols, and air or other gases. They may be made from petroleum distillates, animal fats, plant oils, water and air, or other raw ingredients. Depending on context and on which type of cutting fluid is being considered, it may be referred to as cutting fluid, cutting oil, cutting compound, coolant, or lubricant.

Flood and through-tool delivering of cutting fluid have been widely used for the machining of automotive engines and transmissions. The use of a large amount of cutting fluid can impact the environment and increase manufacturing costs, possibly leads to ground contamination, excess energy consumption, the need for wet chip disposal and potential health and safety issues (Stoll et al., 2008; Filipovic and Stephenson, 2006). Although dry machining can completely eliminate the use of cutting fluids, there are many other problems that affect machining performance, such as poor lubrication, reduced tool life, thermal damage to workpiece and tool, etc. (Sun et al., 2006; Davim et al., 2007; Heinemann et al., 2006). Therefore a near-dry also known as minimum quantity lubrication fluid also came into existence.

Following are some cutting fluid used for CNC lathe machining: 1. Biodegraded esters 2. Renewable acid ester 3. Naturally derived synthetic 4. Vegetable based 5. Synthetic ester

2. Evaluation and Comparison of Cutting fluid.

Five CNC lathe fluid tested samples, named A to E, were acquired from six suppliers, and their known physical properties are listed in Table 1. There is large range in the viscosity of the fluid (8.8 to 69 cSt) and in the flash point (182 to 280^0 C) In this study.

i. Physical properties, including density, viscosity, flash point, and thermal conductivity. Since thermal conductivity information was not provided by the supplier, it was measured in this study to complete the physical properties.

ii. Bench testing, including wettability, tri biological properties and mist characterization. Wettability was determined by the sessile drop method. Tribological properties included lubricity and EP properties, measured with tapping torque and pin-and-vee block methods, respectively. Mist characterization was the measurement of the mist size and concentration generated by each fluid in the machine enclosure.

iii. Machinability, referring to the ease with which a metal can be machined to an acceptable surface finish. An aluminum transmission valve body was adopted as the workpiece. The power consumption to drill and ream the spool bores using different fluids was recorded, and the bore diameters and surface roughness were measured and compared.

TABLE 1 Tested in CNC lathe machine

Fluid	Density (g=mL)	Viscosity (cSt at 40°C)	Flash Point (°C)	Remarks
A	0.93	28	280	Biodegraded esters
B	0.93	8.9	214	Renewable acid esters
C	0.90	10	182	Naturally derived synthetic
D	0.93	10	204	Vegetable based
E	0.93	52	228	Synthetic ester

Physical Properties – Thermal Conductivity

In MQL machining, the same amount of heat is generated as with traditional machining, but much less fluid is available to carry away the heat. Therefore, the thermal properties of the fluid may be an indicator of their heat removal ability. To consider the effect of temperature on MQL lubricants, thermal conductivity was measured at 25, 50, 75 and 90 C using a thermal property analyzer, KD2 Pro (ThermTest Inc., Houston, Texas). A waterbased fluid, Trimsol (marked as WB in all tests), was also tested at a 5% concentration for comparison with the MQL fluids. Each fluid sample was measured in a thermally isolated box with temperature control to ensure the reliability of results.

CONCLUSION:

Biodegradable esters is soluble is water and other fluid used as the cutting fluid in MQL machining.

Viscosity of the Biodegradable ester decrease when it gets soluble in water. Flash of the biodegradable ester is higher than the renewable acid ester, naturally derived synthetic, vegetable and synthetic ester. Due to which this ester can be largely preferred as the cutting fluid a common MWF based on their thermal conductivity, wettability, lubricity, EP properties, mist generation and machinability to determine the importance of fluid properties. Conventional MWFs are typically waterbased whereas MQL lubricants are usually straight oils. As shown in this study, this difference translates into poorer heat removal properties for the MQL lubricants compared to waterbased fluids, but improved wettability and lubricity. Among the MQL lubricants, machining results showed that low fluid viscosity, high mist concentration, large mist droplet diameter and high wettability were best correlated with good machinability. The lack of correlation with EP properties may relate to the mild machining Conditions used in this study, which most likely were not within the boundary lubrication regime. Although it is difficult to draw relationships based on these experimental results, the optimal machining under these mild machining conditions was found with the low viscosity fluids, which corresponded to high mist concentration, large droplet size and good wettability.

REFERENCES

Braga, D.U.; Diniz, A.E.; Miranda, G.W.A.; Coppini, N.L. (2002) Using a minimum quantity of lubricant (MQL) and a diamond coated tool in the drilling of aluminum-silicon alloys. Journal of Materials Processing Technology, 122(1): 127–138. Dasch, J.M.; Kurgin, S.K. (2010) A characterisation of mist generated from minimum quantity lubrication (MQL) compared to wet machining. International Journal of Machining and Machinability of Materials, 7(1–2): 82–95. Davim, J.P.; Sreejith, P.S.; Silva, J. (2007) Turning of brasses using minimum quantity of lubricant and flooded lubricant conditions. Materials and Manufacturing Processes, 22(1): 45–50. Filipovic, A.; Stephenson, D. (2006), Minimum quantity lubrication (MQL) application in automotive powertrain machining. Machining Science and Technology, 10(1): 3–22. Heinemann, R.; Hinduja, S.; Barrow, G.; Petuelli, G. (2006) Effect of MQL on the tool life of small twist drills in deep-hole drilling. International Journal of Machine Tools and Manufacture, 46(1): 1–6. Itoigawa, F.; Takeuchi, D.; Childs, T.H.C.; Nakamura, T. (2007) Experimental study on lubrication mechanism in MQL intermittent cutting process. Machining Science and Technology, 11(3): 355–365. Kamata, Y.; Obikawa, T. (2007) High speed MQL finish-turning of Inconel 718 with different coated tools. Journal of Materials Processing Technology, 192: 281–286.

