

Technology Registry

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4	Area of Technology (e.g. materials, health care, etc.): Nano crystalline Solid Lubricants
5	Web link, if any: www.gmrit.org
6	<p>Description:</p> <p>In the present study, machining experiments are conducted on AISI 1040 steel with the application of boric acid as the solid lubricant which is mixed with canola oil (Green Particulate Fluid Lubricant, GPFL). Boric acid powder with 0.5 microns, 80 nm, 60 nm and 50 nm particle sizes are used. Turning tests are conducted using uncoated carbide inserts under dry, wet (pure canola oil) and MQL (using GPFL) conditions to measure and compare cutting forces, tool temperatures and roughness.</p> <p>The three components of cutting force namely longitudinal feed force, main cutting force and thrust force increased when the particle size is reduced from 538nm to 50nm. Tool temperatures also increased with decrease in the particle size in the nano level. Surface finish of the work material deteriorated as compared to dry and pure canola oil machining. Experimental investigations revealed different phenomena in the nano range of the particle size of solid lubricant and are against the behavior of solid lubricant particle size in the micro level.</p> <p>When the weight percentage of the boric acid is reduced from 7 to 0.5, the cutting forces decreased. Tool temperatures decreased with the decrease in the weight percentage of solid lubricant. Surface finish of the work material improved as compared to dry and pure canola oil machining. Enhanced performance of the particulate fluid lubricant with reduced wt% of solid lubricant indirectly implies an inverse relationship between particle size of solid lubricant and its frictional performance.</p> <p>Performance of SAE 40 oil as a carrying medium of nano boric acid is tested. With SAE 40 oil assisted machining, cutting forces, tool temperatures and surface roughness increased with reduced particle size of boric acid in nano-level. The observed phenomenon is similar to that of canola oil assisted machining. As the wt% of the boric acid nanoparticles in SAE 40 oil is decreased from 7 wt% to 0.5, all the machining parameters decreased. This is similar to the phenomena observed with canola oil assisted machining.</p> <p>When the wt% of nano boric acid (irrespective of carrying medium) is 7, all the machining parameters are high as compared with dry machining. This is especially true with 50 nm sized particles than 538 nm particles.</p> <p>Relative performance of canola oil and SAE 40 oil as a carrying medium is compared. Feed and cutting force components showed better performance with canola oil as compared with SAE 40 oil. Thrust force measurements are in favor of SAE 40 oil, however, is not that much prominent. Tool temperature and surface roughness measurements were low with SAE 40 oil carrying medium for all the cases studied.</p>

	Compared to canola oil SAE 40 oil has found to be a better carrying medium because of its better machining performance.
7	Keywords: Nano boric acid, canola oil, SAE 40 oil, turning, hardened steel