Vegetable-based Oil as a Sustainable Lubricant for Machining Process

言語 / 英語 Language/English

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東京農工大学 小金井キャンパス 9号館5階505会議室
Room 505, 5th Fl., Building 9, Koganei Campus, TUAT

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Continuous implementation of lubricants from renewable sources such as animal fats, vegetable oils and biolubricants as metalworking fluids in machining applications was contributed by the increase awareness from human health deficiency and bad environmental impacts as well as on sustainable development for future manufacturing activities. Renewable lubricants from vegetable oils are very attractive as alternative lubricant source which pose relevant properties such as highly biodegradable, non-toxic, have good lubricating properties, are made from renewable sources and bear low production costs. Vegetable-based metalworking fluids from palm oil and jatropha oil are desirable as the alternative to mineral oil that possessed negative effect to human and environment. The assessment of its performance was conducted tribological and machinability aspects. Both palm and jatropha oils were chemically modified through various processes and added with an additive, such as ionic liquid and hexagonal boron nitride. The tribological properties of the palm and jatropha oils were further improved in terms of its friction and wear performances by adding the additives. The machining performances of these newly invented vegetable-based MWFs were evaluated in terms of cutting forces, cutting temperature, surface roughness and tool life during turning of AISI 1045 medium carbon steel using uncoated cermet inserts under MQL technique. The thin lubrication film formed by the vegetable-based oils was able to withstand the friction at the tool-workpiece interface, resulted in low cutting force, low cutting temperature, lower surface roughness value and prolonged tool life. This phenomenon was attributed to the formation of long and branched carbon chains in palm and jatropha oils molecule which increased the absorption film ability. From the results of the tribological and machining performances evaluations, the newly developed vegetable-based MWFs were significantly surpassed currently used synthetic ester thus provides new opportunities for minimum quantity lubrication-based oil.

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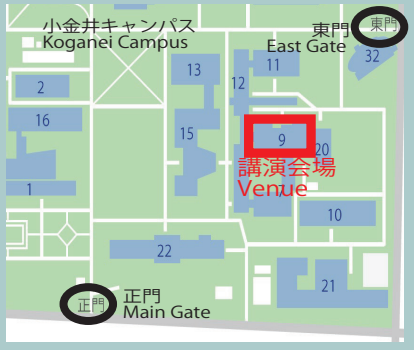

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