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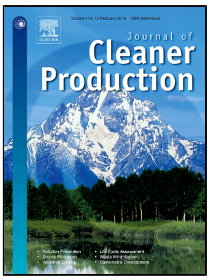


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| PII: | S0959-6526(18)30003-9 |
| DOI: | 10.1016/j.jclepro.2018.01.003 |
| Reference: | JCLP 11683 |
| To appear in: | *Journal of Cleaner Production* |
| Received Date: | 20 June 2017 |
| Revised Date: | 30 December 2017 |
| Accepted Date: | 02 January 2018 |

Please cite this article as: Farzad Pashmforoush, Reza Delir Bagherinia, Influence of water-based copper nanofluid on wheel loading and surface roughness during grinding of Inconel 738 superalloy, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.01.003

# Influence of water-based copper nanofluid on wheel loading and surface roughness during grinding of Inconel 738 superalloy

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**Abstract**

Grinding fluids play significant role in minimizing production cost and energy. However, conventional cutting fluids contain harmful and destructive chemical constituents causing various environmental threats and operator hazards such as asthma, pneumonia, skin problems, allergic reaction and cancer. Most of the conventional fluids used in machinery industry are petroleum-based oils which their disposal leads to air and soil pollution and water contamination. In this regard, eco-friendly nanofluids are good alternatives due to less environmental threats in addition to high thermal conductivity and supreme cooling/lubricating efficiency. Besides anti-bacterial properties of some nanoparticles such as copper and silver, application of such nanofluids eliminates the need for toxic cutting fluids used frequently in the industry, hence reducing the environmental pollution, skin problems and breathing irritations. Hence, in this study, the effect of the environmentally friendly water-based copper nanofluid was investigated in grinding performance of Inconel 738 superalloy, as one of the hard-to-machine materials extensively used in the manufacturing of jet engine and gas turbine components. To evaluate the effectiveness of this nanofluid, the wheel loading ratio and surface roughness values were compared with those of dry grinding and conventional fluid grinding using image processing technique. Also, the effect of process parameters such as: feed velocity, depth of cut and concentration of nanoparticles was statistically investigated using ANOVA analysis and finally an empirical-mathematical model was developed for wheel loading ratio and surface roughness. The obtained results revealed that application of copper nanofluid could improve wheel loading and surface roughness by amount of