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PII: S0257-8972(16)30723-X
DOI: doi: 10.1016/j.surfcoat.2016.05.092
Reference: SCT 21432

To appear in: *Surface & Coatings Technology*

Received date: 31 March 2016
Accepted date: 22 May 2016

Please cite this article as: S. Bhowmick, G. Sun, A.T. Alpas, Low friction behaviour of boron carbide coatings (B_4C) against Ti-6Al-4 V, *Surface & Coatings Technology* (2016), doi: 10.1016/j.surfcoat.2016.05.092

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ABSTRACT

Boron carbide (B_4C) is a potential tool coating for machining of titanium alloys because of its high hardness and high temperature stability. In addition, B_4C coatings annealed at 600 °C, form a layer of that acts as solid lubricant leading to low coefficient of friction, COF, against titanium. This paper shows that a transfer layer consisting of graphite could be established on B_4C surface when sliding against Ti-6Al-4V and passivation of graphitized carbon would reduce COF. Ball-on-disk (B_4C) type sliding tests were performed in dry air, argon and nitrogen atmospheres (<0.5% RH), and in air with humidity levels varying between 25% and 85% RH. B_4C samples were also tested while they were immersed in water, ethanol (C_2H_5OH) and iso-propyl alcohol (C_3H_7OH). The B_4C coatings exhibited high COF values of 0.59-0.65 in dry atmospheres. Sliding under an air atmosphere containing 70% RH reduced the steady state COF to 0.25 and further reduction COF to 0.20 was recorded in air with 85% RH. A COF of 0.15 was measured when the tests were carried out in ethanol and 0.07 in iso-propyl alcohol. Low COF values of B_4C were attributed to H and OH passivation of the graphitized transfer layers observed by the Raman, Fourier transform and X-ray photoelectron spectroscopy techniques.

Key words:

Boron carbide; humidity; lubrication; passivation; graphitization

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