EFFECTIVENESS OF FATTY ACIDS ON WEAR RESISTANCE OF ANODIC COATINGS

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Utilization of anodized aluminum (Al) for high-tech application is increasing rapidly. Despite its hardness, wear of anodic coating remains one of the major problems. Polytetrafluoroethylene (PTFE) coatings are often used to improve the wear resistance of anodized Al. Nevertheless, the non-wetting nature and high molecular size of PTFE polymers are not favorable for penetrating into nanopores of anodic coating. As an alternative, two fatty acids (FA) were tested for friction on anodized alloys 6082 (96.7% Al) and 7075 (87.4% Al).

Technical grade oleic a. (70% pure), lauric a. (>90% pure) and fluoropolymer-based DryFilm RA/IPA dispersion of 25% solids (DuPont) were used for impregnating the anodic coatings. Anodization was performed in H_2SO_4/oxalic a. (Type III) electrolyte, producing hard Al_2O_3 coatings of 60 μm thickness [1]. The anodized specimens were immersed in heated FA for 1 hour at 90 °C, then pulled out and suspended for dripping off. For PTFE coatings, the substrates were placed into the tube furnace RS 80/500/11 (Germany) at 310 °C for 10 min curing, then taken out from the furnace and optionally rubbed with lint-free cloth for 10-15 s before cooling below 90 °C for thermo-mechanical treatment, as recommended by the manufacturer. Ball-on-Disc Tribometer Micro-PoD TR-20 M63 (Ducom) was used for friction tests. A bearing steel 100Cr6 ball of 6 mm OD and 96.5% purity was fixed into the holder and pressed under the 50 N load against the coated specimen, mounted on a rotary part. The rotational motion of 500 rpm resulted in track length of 31.4 mm for one revolution.

Effectiveness of PTFE did not improve because of thermo-mechanical treatment, Fig. 1.

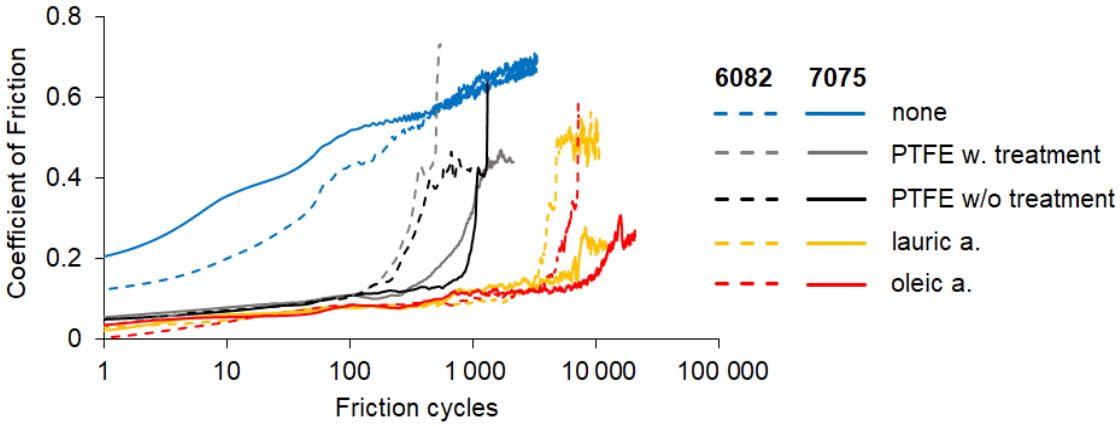

Fig. 1. Influence of PTFE and FA on friction tendencies of anodized 6082 and 7075 alloys under 50 N load

Nanopores of less than 20 nm were not large enough for PTFE to penetrate. Lauric and oleic a. appear much more effective in wear inhibition, being able to withstand nearly 10 000 friction cycles with COF ~ 0.1 under 50 N load. Finetuning of FA composition can lead even to further improvements in tribological performance.

Acknowledgments

This work was supported by the Lithuanian federal research project [grant number 01.2.2-CPVA-K-703-03-0024].

References

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