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Abstract:

Cathodic plasma electrolytic deposition (CPED) was applied to efficiently produce a thick ceramic coating with superior wear and corrosion resistance on aluminium alloy. Ceramic composite coatings were synthesized in a glycerin-carbamide-based electrolyte with and without zirconium nitrate, and their phase components, morphologies and compositions were characterized by X-ray diffraction (XRD), Raman spectroscopy, scanning electron microscopy (SEM) and energy disperse spectroscopy (EDS). The tribological behaviour and electrochemical corrosion resistance were also evaluated. The results show that Al_3C_4-Al_2O_3 and Al_3C_4-Al_2O_3-ZrO_2 coatings with thicknesses of 65 μm and 50 μm, respectively, were produced by DC-powered CPED in only 7 min. Relative to the uncoated alloy, both coated samples exhibited a much lower friction coefficient and wear rate. The ZrO_2 incorporated in the coating enhanced the hardness of the coating and dramatically decreased the friction coefficient to 22% of that of the uncoated alloy. The incorporation of ZrO_2 also increased the brittleness, resulting in a slightly higher wear rate than that of the ZrO_2-free coating. The wear mechanisms of the