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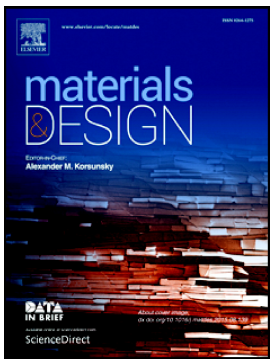

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Residual stress gradient and relaxation upon fatigue deformation of diamond-like carbon coated aluminum alloy in air and methanol environments

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Abstract:

Amorphous diamond-like carbon coating (DLC) of 2 micron in thickness was deposited over the aluminum alloy substrate using magnetron sputtering deposition technique. In order to understand the efficacy of coating deposition, coated specimens were subjected to rotating bending fatigue in air and methanol environments respectively. Raman spectroscopy was used in conjunction with grazing incidence X-diffraction technique to obtain depth-resolved residual stress gradients of coated-aluminum substrate. The residual stress generated due to coating deposition was calculated using Raman spectroscopy and it was -1.13 ± 0.16 GPa (compressive in nature). Furthermore, Raman spectroscopy was utilized for the quantification of stress relaxation upon fatigue loading in air and methanol environments. It was observed that the irrespective of the testing environment, good correlation exists between the stress relaxation magnitude and number of cycles endured before failure.

Keywords: Diamond-like coating; Methanol; Residual stress; Raman shift; Grazing incidence.

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