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Properties of Ti and Al co-doped diamond-like carbon coatings deposited by RF PECVD/DC magnetron sputtering hybrid process

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The metal-doped diamond-like carbon (Me-DLC) films characterized by the incorporation of metals in their structure have attracted much attention because of promising properties such as low friction coefficient, low residual stress, high hardness, and high wear-resistance. The combination of both metals, carbide formers and non-carbide formers, as dopants in DLC films can be a good way to adjust the properties of DLC coatings. In this work, films of DLC doped with both non-carbide former Al and carbide former Ti were deposited by a hybrid deposition process that combines radio frequency plasma enhanced chemical vapored position (RF PECVD) and DC magnetron sputtering in $Ar/H_2/C_2H_2$ gas mixture atmosphere. Al:Ti-DLC coatings with different compositions were deposited on steel and silicon substrates. Effects of experiment parameters on structure and mechanical properties of Al and Ti co-doped DLC films were investigated by XPS, Raman spectroscopy and nanoindentation. The friction and wear behaviors of the as-deposited films were investigated using a CSM tribometer. The wear of steel balls and debris after sliding were analyzed by Energy Dispersive Spectroscopy (EDS).

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