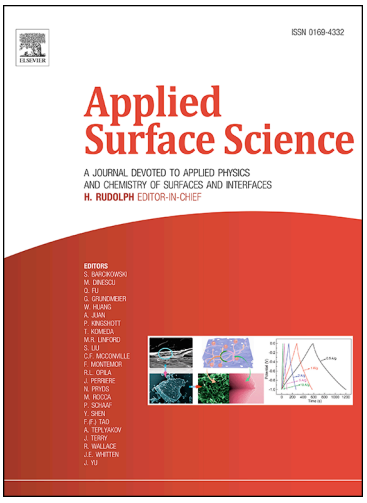

Full Length Article

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Oxygen bonding configurations and defects on differently oxidized diamond surfaces studied by high resolution electron energy loss spectroscopy and X-ray photoelectron spectroscopy measurements

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Abstract

In this work, the interaction of oxygen with polycrystalline diamond film surface exposed to vacuum ultraviolet ozone (UVO), chemical acid and oxygen plasma treatments was investigated. The surfaces were characterized by high resolution electron energy loss spectroscopy (HREELS) and X-ray photoelectron spectroscopy measurements (XPS). HREELS results showed that the diamond surfaces were reconstructed by forming C=C, $=CH_x$, ≡CH or C-H(*def*) bonds, upon the conversion to oxygen-terminated diamond (O-diamond). The plasma O-diamond had the highest level of surface reconstruction and defects, followed by the UVO and acid diamond. The coverage of oxygen for the UVO, acid and plasma O-diamond was calculated to be 0.86, 0.58 and 0.90 monolayer, respectively. The fractions of oxygen containing components such as C-O-C, C-O-O-C, C=O and -COH were also compared for the O-diamond surfaces. These components were carefully assigned in the XPS spectra by comparing the HREELS results. Furthermore, surface band bending was discussed by analyzing the binding energy shift of the sp^3 C-C components. In the end, thermal stability of surface bonding configurations were investigated by annealing the diamond film in ultrahigh vacuum chamber at high temperatures.

Keywords: Diamond; HREELS; XPS; surface reconstruction; oxygen termination.

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