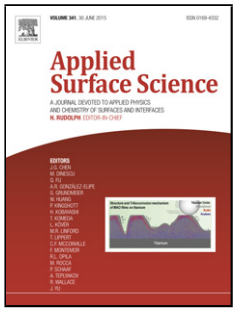

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UHV AFM based colloidal probe studies of adhesive properties of VAlN hard coatings

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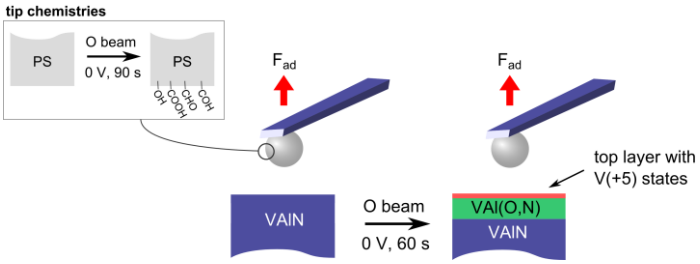
Additional Supporting Information may be found in the online version of this article.

Graphical abstract



Highlights

- The adhesive properties of VAlN (oxidized/non-oxidized) were investigated in UHV
- Oxidation formed a highly polarizable oxynitride terminated with oxidic V(+5) ions
- The adhesion to polystyrene due to van der Waals (vdW) forces is thus unaffected
- vdW forces significantly contribute to adhesion even in the presence of coordinative and electrostatic forces

Abstract

The adhesion of polystyrene (PS) on $V_{0.27}Al_{0.29}N_{0.44}$ and the related influence of the oxidation states of both surfaces was investigated using X-Ray Photoelectron Spectroscopy (XPS) and Colloidal Force Spectroscopy (CFS) in Ultra-High Vacuum (UHV). Complementary, the intimate relation between the adhesion force, the chemical structure and surface polarizability was investigated by XPS valence band spectroscopy and the calculation of non-retarded Hamaker coefficients using Lifshitz theory based on optical data as derived from Reflection Electron Energy Loss Spectroscopy (REELS) spectra. The combined electron and force spectroscopic analysis of the interaction forces disclosed quantitatively the separation of the adhesion force in van der Waals and Lewis acid-base contributions. Further, the