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Modification of the dry lubricant powders polyetheretherketone, polyimide and hexagonal boron nitride by atmospheric pressure plasma and subsequent embedding into nickel dispersion coatings

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Aim of this work was to achieve an improved dispersibility of hydrophobic dry lubricants in aqueous media through plasma activation. As a result, the use of wet chemical and environmentally questionable substances, e.g. certain surfactants, to ensure the dispersibility of such particles, can be avoided. Those plasma-activated particles can be embedded in electroless nickel coatings to improve their wear resistance.
Therefore, hydrophobic polymeric powders like polyimide and polyetheretherketone as well as ceramic powders based on hexagonal boron nitride were treated with atmospheric pressure plasma in a diffuse coplanar DBD-system. The generation of polar chemical bonds on the powder surface lead to an improved dispersibility of the powders in aqueous media and therefore in the electrolyte medium used for nickel electroless plating. As a results a higher deposit volume of the particles in the nickel dispersion coatings could be observed. The modified bonding conditions at the powder surfaces were analysed by infrared and x-ray photoelectron spectroscopy. Optical microscopic and SEM investigations of the nickel coatings in cross sectional view showed the distribution of embedded powder particles in the growing film matrix. Furthermore, the coating´s wear resistance was investigated by taber-abraser test.
The plasma activation lead to surface modifications namely a linkage of polar groups at the powder surfaces and therefore to an improved dispersibility. The embedding of these plasma-functionalised particles in electroless nickel coatings was possible with all three investigated materials, correspondingly the wear resistance of such dispersion coatings was improved compared to pure nickel coatings.

Keywords
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electroless metal deposition