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STUDY OF WETTABILITY OF MAGNETRON SPUTTERED W-S-C-F COATINGS ONTO ANODIZED ALUMINUM ALLOY SUBSTRATES

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In industry, in many applications, components are often in mechanical contact which require lubricant application leading to the breakdown of production processes due to cleaning and maintenance operations. The development of functional surfaces; addressing either longer lifetime due to an improvement of the wear resistance, or energy savings, by the decrease of the friction, is now welcome particularly when they can also avoid or reduce the excessive use of liquid lubricants harmful for the environment and the human health.
The development of materials with different wettability behaviours usually relies on micro/nano-structuring surface methods and / or on chemical modification based on silanes-based coatings which present polymeric behaviour leading to poor mechanical resistance. So, the creation of a wear resistant metallic surface with a specific non-common wettability behaviour (hydrophilic-oleophobic), which can be simultaneously self-cleaning and anti-greasy, is desirable for some industrial applications.
This work envisages a new solution, gathering the outstanding self-cleaning and near zero friction properties of tungsten disulphide (WS_2), alloyed with carbon to get an improved mechanical resistance, and the doping with fluor, to achieve a final material with water and oil wettability control. Therefore, W-S-C-F coatings were produced by magnetron sputtering in reactive mode using an Ar/CF_4 gas mixture on previously anodized aluminum alloy substrates. The fluor was inserted (0-20 at. %) in the produced coatings by varying the CF_4 partial pressure. Morphology, chemical composition / bonding, structure and wettability characterization of the coatings were respectively performed through SEM-EDS, XRD techniques and water/oil contact angle measurements. Mechanical properties such as hardness, elastic modulus and adhesion were also conducted under nanoindentation procedures and scratch testing.

Keywords
magnetron sputtering
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fluor doping
aluminum alloys
wettability