Synthesis of Magneli phases of titanium (Ti\textsubscript{n}O\textsubscript{2n-1}) / AlTiN duplex coatings and wear behaviour in dry sliding contact

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Titanium Magneli phases (Ti\textsubscript{n}O\textsubscript{2n-1} (4 \leq n \leq 9)) are known to present interesting tribological properties for low wear applications [1, 2]. The existence domain of Magneli phases in the Ti-O diagram being limited, it remains difficult to synthesise such compounds. In most published studies, films composed of these phases are obtained either by thermal spraying [3], laser chemical vapour deposition, or by sol-gel route [4]. However, few papers deal with the deposition of Magneli phases films by physical vapour deposition through controlling the oxygen content in the chamber of reactor.

In this paper, we investigate the deposition by reactive magnetron sputtering of Ti-O coatings as a function of the oxygen flow rate at a temperature about 873 K. Then, titanium Magneli phases’ coatings are synthesised with different thicknesses. The substrates are AISI M2 high speed steels previously covered with an AlTiN sub-layer deposited by reactive arc deposition.

The chemical, structural, mechanical and tribological characteristics of the coatings are presented as a function of the oxygen flow rate and the thickness of Ti-O layer of the duplex coatings. High load indentation tests are used to characterise the coating’s brittleness and the pin-on-disc tests at ambient and high temperatures are performed to assess the fiction and wear resistance of those coatings in particular conditions of use.


Keywords
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