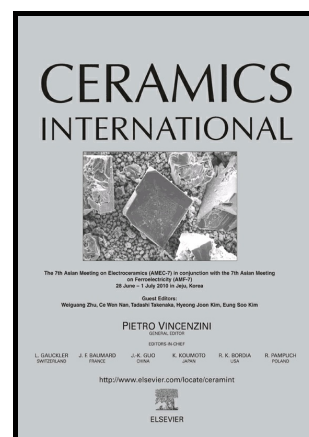


Thermal stability and oxidation resistance of V-alloyed TiAlN coatings

Yu X. Xu, Li Chen, Fei Pei, Jian L. Yue, Yong Du



www.elsevier.com/locate/ceri

PII: S0272-8842(17)32293-9
DOI: <https://doi.org/10.1016/j.ceramint.2017.10.100>
Reference: CERI16519

To appear in: *Ceramics International*

Received date: 18 August 2017
Revised date: 26 September 2017
Accepted date: 16 October 2017

Cite this article as: Yu X. Xu, Li Chen, Fei Pei, Jian L. Yue and Yong Du, Thermal stability and oxidation resistance of V-alloyed TiAlN coatings, *Ceramics International*, <https://doi.org/10.1016/j.ceramint.2017.10.100>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Thermal stability and oxidation resistance of V-alloyed TiAlN coatingsYu X. Xu ^a, Li Chen ^{a,*}, Fei Pei ^{a,b}, Jian L. Yue ^{c,*}, Yong Du ^a^a State Key Laboratory of Powder Metallurgy, Central South University, Changsha 410083, China^b Key Laboratory of Marine Materials and Related Technologies, Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, Ningbo Zhejiang, 315201, China^c School of Aeronautics and Astronautics, Central South University, Changsha 410083, China

Abstract: V-containing nitride coatings recently attract a wide range of research interests owing to their excellent tribological properties. To evaluate their comprehensive properties, a comparative study on the intrinsic thermal stability and oxidation resistance of TiAlN and TiAlVN coatings are conducted here. $\text{Ti}_{0.56}\text{Al}_{0.44}\text{N}$, $\text{Ti}_{0.50}\text{Al}_{0.44}\text{V}_{0.06}\text{N}$, and $\text{Ti}_{0.40}\text{Al}_{0.50}\text{V}_{0.10}\text{N}$ coatings, deposited by cathodic arc evaporation, exhibit a single-phase face-centered cubic structure with a hardness of 28.9 – 29.8 GPa. The V-containing coatings show a pronounced age-hardening upon annealing, which contributes to a hardness increase of 3.7 and 4.8 GPa at 800 °C for $\text{Ti}_{0.50}\text{Al}_{0.44}\text{V}_{0.06}\text{N}$ and $\text{Ti}_{0.40}\text{Al}_{0.50}\text{V}_{0.10}\text{N}$, respectively, corresponding to 2.9 GPa for $\text{Ti}_{0.56}\text{Al}_{0.44}\text{N}$. Also, alloying with V retards the formation of wurtzite AlN upon annealing, especially in $\text{Ti}_{0.50}\text{Al}_{0.44}\text{V}_{0.06}\text{N}$, and thus keeps a higher hardness above 30 GPa even annealing at 1100 °C, while the hardness of $\text{Ti}_{0.56}\text{Al}_{0.44}\text{N}$ significantly reduces to 27.8 ± 0.6 GPa. However, alloying with V into TiAlN leads to an earlier formation of rutile TiO_2 and also Ti-rich oxide top-layer on the outside surface instead of dense Al_2O_3 , and thus degrades the oxidation resistance. When exposed to air at 700 °C for 10 h, the $\text{Ti}_{0.50}\text{Al}_{0.44}\text{V}_{0.06}\text{N}$ and $\text{Ti}_{0.40}\text{Al}_{0.50}\text{V}_{0.10}\text{N}$ coatings suffer from a severe oxidation, whereas only a compact oxide scale with a thickness of ~80 nm for $\text{Ti}_{0.56}\text{Al}_{0.44}\text{N}$ is formed.

Keywords: Films; TiAlVN; Hardness; Thermal properties

* Corresponding author. E-mail address: chenli_927@126.com (L. Chen); jlyue2010@csu.edu.cn (J. L. Yue)

Download English Version:

<https://daneshyari.com/en/article/7888977>

Download Persian Version:

<https://daneshyari.com/article/7888977>

[Daneshyari.com](https://daneshyari.com)