

## 나노 다층 TiAlSiN 박막의 고온 산화 High-temperature Oxidation of Nano-multilayered TiAlSiN Films

이동복\*, 김민정

성균관대학교 신소재공학과(E-mail: dlee@skku.ac.kr)

**초 록 :** In this study, the Al-rich AlTiSiN thin films that consisted of TiN/AlSiN nano-multilayers were deposited on the steel substrate by magnetron sputtering, and their high-temperature oxidation behavior was investigated, which has not yet been adequately studied to date. Since the oxidation behavior of the films depends sensitively on the deposition method and deposition parameters which affect their crystallinity, composition, stoichiometry, thickness, surface roughness, grain size and orientation, the oxidation studies under various conditions are imperative. AlTiSiN nano-multilayer thin films were deposited on a tool steel substrate, and their oxidation behavior of was investigated between 600 and 1000 °C in air. Since the amount of Al which had a high affinity for oxygen was the largest in the film, an  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>-rich scale formed, which provided good oxidation resistance. The outer surface scale consisted of  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> incorporated with a small amount of Ti, Si, and Fe. Below this outer surface scale, a thin (Al<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub>, SiO<sub>2</sub>)-intermixed scale formed by the inwardly diffusing oxygen. The film oxidized slower than the TiO<sub>2</sub>-forming kinetics and TiN films, but faster than  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>-forming kinetics. During oxidation, oxygen from the atmosphere diffused inwardly toward the reaction front, whereas nitrogen and the substrate element of iron diffused outwardly to a certain extent.

**감사의 글:** 본 연구는 2014년도 산업통상자원부의 재원으로 한국에너지 기술평가원(KEPTEP)의 지원을 받아 수행한 연구 과제입니다. (No.20143030050070)

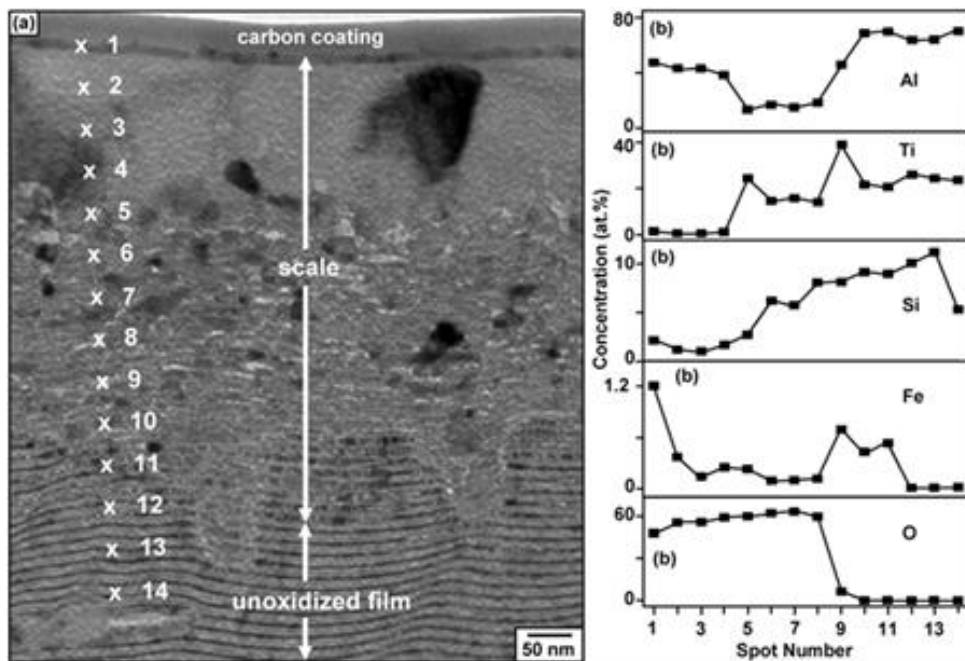


Fig. 1. TEM analyses of the AlTiSiN film after oxidation at 900 °C for 20 h in air.

(a) cross-sectional image, (b) EDS line profiles of Al, Ti, Si, Fe and oxygen along points 1-14.