TiO_2-WO_3 Nanotubular Composite Synthesized by Anoidzation of Simultaneous Multi-target Sputtered Thin Films Characterized by Laser Ablation ICP-MS

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Titania nanotube arrays (T-NTA) synthesized by electrochemical anodization have received considerable attention for a variety of technical applications [1]. Deposition of thin Ti films (300-1,000 nm) on Si wafers by e-beam evaporation or sputtering is one method to synthesize T-NTA with site specific and patterned growth utilizing photolithographic methods [2] (Fig 1). During metal sputtered film deposition, multiple source targets can be used to simultaneously deposit two or more metals.

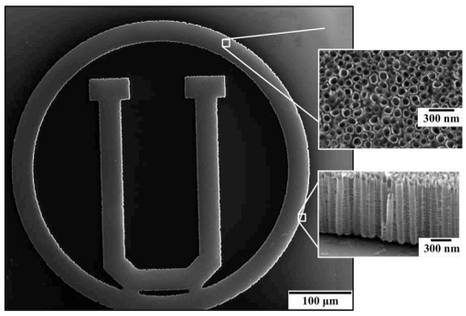

Fig 1.

In this study, 500 nm Ti-W nanocomposite thin films were deposited into Si wafers and conducting glass where the amount of W atoms deposited was varied from 5 x 10^{18} to 2 x 10^{19} atoms/cm^3. These films were then subject to electrochemical anodization to form a TiO_2-WO_3 nanotubular composite and subsequently calcined in air at 250-550 ^oC.

Laser ablation ICP-MS (LA-ICP-MS) was used to characterize the composition of the thin film before and after anodization (Fig. 2) and calcination. LA-ICP-MS allows for analysis of localized composition with high accuracy (1~2%) with minimal destruction to the sample. Traditional ICP-MS analysis of these samples would require acid digestion of the entire sample whereas utilizing LA-ICP-MS allows for analysis of 5~350 µm sample spot sizes enabling analysis of the sample throughout all the synthesis steps.

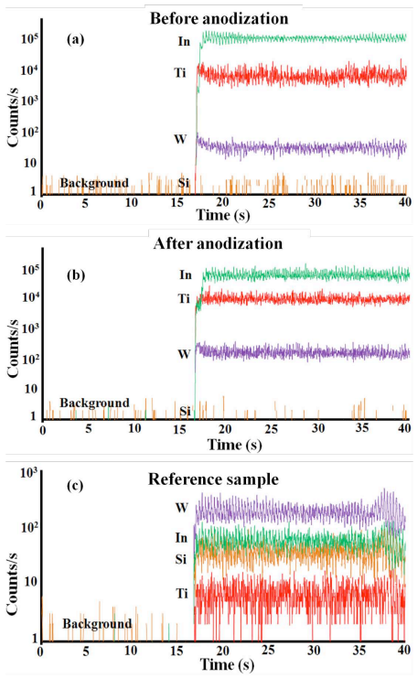

Fig 2. Ti-W thin film deposited on ITO glass before anodization (a), after anidzation (b), and a reference sample (c).

References

[1] Schmuki *et al*, *Angew Chm Int Ed*, **2011**, *50*, 2904

[2] Mohanty *et al*, *Nano Res Lett*, **2012**, *12*, 388.; Misra *et al*, *Nanotechnology*, **2012**, *23*, 385601.

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