Special Interest Talks

Room Town & Country A - Session SIT1-MoSIT

Special Interest Session I

Moderator: Jyh-Wei Lee, Ming Chi University of Technology, Taiwan

1:00pm **SIT1-MoSIT-1 Residual Stress Measurement on Hard Coatings and the Evaluation of Energy Relief Efficiency of Architectured Coatings*, Jia-Hong Huang,*** National Tsing Hua University, Taiwan **INVITED**

Hard coatings deposited by physical vapor deposition are usually sustained high residual stress that could lead to many problems in the applications, such as delamination and spallation of coating, thereby reducing the service duration of the products. To solve residual stress problem in hard coatings, the stress should be correctly measured. In the first part of this talk, the method of stress measurement will be reviewed, mainly focusing on the $\cos^2\alpha\sin^2\psi$ X-ray diffraction method [1] and a recent developed technique, the average X-ray strain (AXS) method, which was a more accurate technique based on the previous $\cos^2\alpha\sin^2\psi$ method [2]. Examples of the applications will be briefly mentioned. In the second part of the talk, the estimation of stress relief efficiency by metal interlayer using an energy balance model will be introduced. One of the most common approaches in dealing with residual stress issue is by introducing a metal interlayer in between the hard coating and substrate, by which residual stress is expected to be partly relieved and adhesion strength of the coating may be enhanced. However, the selection of metal and the thickness of interlayer is usually based on empirical rules without theoretical basis. Therefore, the efficiency of stress relief by using a specific metal with a certain thickness cannot be properly estimated. Recently, we proposed an energy balance model to evaluate the energy relief efficiency by the interlayer and further understand the relation between stress relief and plastic deformation [3]. The model hypothesized that stored elastic energy in the hard coating and the bending energy in the Si substrate could be partially relieved by the plastic deformation of the metal interlayer. The model has been applied on TiN/Ti, ZrN/Ti and ZrN/Zr bilayered coatings on Si substrate, where the energy relief efficiency can be estimated; furthermore, the contributions of energy relief by hard coating and substrate are separately assessed. The model was also applied on TiZrN/TiN/Ti tri-layered coatings on Si substrate, and the energy relief efficiency was successfully evaluated.

Reference

[1] C.-H. Ma et al., Thin Solid Films 48 (2002) 73.

[2] A. Wang et al., Surf. Coat. Technol. 262 (2015) 40.

[3] J. -H. Huang et al., Surf. Coat. Technol. 434 (2022) 128224.

Author Index

Bold page numbers indicate presenter

— H —
Huang, J.: SIT1-MoSIT-1, **1**