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Analysis of thin-film system with Michelson interferometer

DAVID DIDIE, DANIEL DIDIE, Southeastern Louisiana University, HAE-SUNG PARK, Seoul National University of Science and Technology, SANICHIRO YOSHIDA, Southeastern Louisiana University, IK-KEUN PARK, Seoul National University of Science and Technology — A Michelson interferometer was used to characterize the adhesion of thin-film systems. A thin-film specimen was configured as an end-mirror of the interferometer with the film surface facing the beam splitter and oscillated with an acoustic transducer from the rear. The film-surface oscillation amplitude was evaluated as the relative optical path difference of the two arms behind the beam splitter. With the beams slightly tilted with each other, the path difference was observed as parallel interference fringes. The oscillation amplitude was quantified as the reduction in the fringe contrast in the spatial-frequency domain. Our specific interest was to test specimens in an oscillation frequency range of actual uses of thin-film products. Thus, audible acoustic frequency was used. 100 nm-thick platinum (Pt) films coated on a silicon (Si) substrate were used as sample specimens. A Pt-film coated on a surface-treated Si substrate and Pt-film coated on an untreated Si substrate specimens were tested for comparison. The treated and untreated specimens indicated resonance-like behavior around 8 kHz and 13 kHz, respectively. The base-line test on an uncoated Si specimen confirmed that the observed behavior represents dynamics of the film-substrate interface.

Sanichiro Yoshida
Southeastern Louisiana University

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