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Thin-film adhesion characterization by Colored Picosecond Acoustics

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Abstract

This paper presents some applications of a recent technique so-called the Colored Picosecond Acoustics (APiC) to the characterization of complex stacks of thin films. The technique is a unique combination of optics and acoustics that implements an acoustic pulse-echo technique at the nanoscale using a tunable ultrafast laser. From the experimental point of view, it is a full optical setup, acoustics taking place in the sample only. Very high frequency acoustic waves (up to several hundreds of GHz) are emitted and detected using ultra-short laser pulses. The capabilities of the APiC technique are demonstrated on various thin-film samples made of metals, dielectrics and semiconductors. Ultra-high frequency acoustic waves are first used to assess the film thickness or to measure thin-film elasticity via the acoustic time-of-flight measurement. A great potential is the capability to detect adhesion defects at buried interface through an analysis of the acoustic reflection at the concerned interface. Acoustic mapping of the sample surface reveal, in non-destructive manner, weak points at the buried interface.

Keywords: adhesion; thin film; thickness; ultrafast acoustics.

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