Characterisation of viscoelastic films on substrate by acoustic microscopy. Direct and inverse problems.

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Date de la soutenance
18/12/2024 à 14:00

Lieu de la soutenance
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Abstract

In the framework of this PhD thesis, the characterisation of the thick and thin films deposited on a substrate has been done using acoustic microscopy via direct and inverse problem-solving algorithms. Namely the Strohm's method is used for direct problem-solving while a variety of mathematical models including Debye series model (DSM), transmission line model (TLM) and spectral method using ratio between multiple reflections model (MRM) have been used to solve inverse-problem. A specific application of acoustic microscopy has been used consisting of mounting the plane-wave high frequency (50 MHz and 200MHz) transducers instead of use of the traditional focus transducers used for acoustic imaging as well as using full-wave A-scan which could be well extended to bulk analysis of consecutive scans. Models have been validated experimentally by a thick film made of epoxy-resin with thickness of about 100µm and a thin film made of polish of about 8µm. The characterised parameters include mechanical parameters (e.g. density and thickness) as well as viscoelastic parameters (e.g. acoustic longitudinal velocity and acoustic attenuation) and occasionally transducer phase-shift.