A Measurement of Thin Film Properties with the RUSpec Method

from Vibrations of Covered Elastic Cuboids

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**Abstract:**

In modern products from advanced manufacturing processes like semiconductor and electronic device industries, thin films are frequently utilized for essential functions such as conductive layers and functioning materials for various applications. With sophisticated processing techniques, thin films can be coated on surfaces of various substrates with relatively thin thickness and desired planner patterns to satisfy application needs. It is known that thin films are made from bulk materials by a phase transformation technology, and the large temperature variation will induce many changes related to the physical properties and material formation. As a result, concerns about property changes in thin films are justified and should be addressed to support product development efforts. In this study, we start with a cuboid sample coated with thin films on faces. The vibrations of such a coated cuboid are formulated with the Rayleigh-Ritz method as a layered structure. With one set of displacement functions in the entire structure, strain and kinetic energies are calculated separately with the consideration of different material properties and sizes, providing the basis for the determination of unknown properties of materials through the frequency solutions. By combining this analysis with the RUSpec technique, we can obtain the physical properties of the thin film layers based on the frequency variations. With the advantages of easy-use and simple sample preparation, this will be a simple and accurate method for the evaluation of the physical properties of thin films which can be found in many applications today.

**Biography of Presenting Author:**

**Professor Ji Wang** is the founding director of the Piezoelectric Device Laboratory, Ningbo University. Professor Ji Wang also held visiting positions at Chiba University, University of Nebraska-Lincoln, and Argonne National Laboratory. He received his PhD and Master’s degrees from Princeton University in 1996 and 1993 and a bachelor’s degree from Gansu University of Technology in 1983.

Professor Wang has been working on acoustic waves and high-frequency vibrations of elastic and piezoelectric solids for resonator design and analysis with several US and Chinese patents, over 200 journal papers, and frequent invited, keynote, and plenary presentations at major conferences around the world.

