TESTING AND EVALUATING FLEXURAL STRENGTH OF STACKED SILICON DIE CONFIGURATIONS

Ankita Korad[(1)], Daryl Santos[(1)], Krishnaswami Srihari[(1)], Salvatore Napoli[(2)]

[(1)] Watson Institute for Systems Excellence,

Binghamton University - State University of New York (SUNY)

[(2)] Analog Devices, Inc.

Abstract: Decrease in overall package size and package footprint coupled with increase in functionality and performance requirements, brings challenges of processing, handling, and assembling thinner dies in semiconductor packaging. At the same time, high reliability remains a critical necessity. In case of 3D packages or stacked die packages, structural integrity and mechanical robustness of the die stack is critical for its uncompromised functionality. In stacked die packages, silicon wafers must be backgrounded thinner, and dice are fixed by means of adhesive pastes or die attach films. Then the mechanical strength of the stacked structure is dominantly a function of the layers of die attach between multiple substrates and whether the package is a molded one or a cavity type. Due to its brittle nature, high flexural stresses induced in the die structure during packaging and assembly processes (thermomechanical stresses), and also during reliability and functionality tests, could result in detrimental fracture in the die. The purpose of this study is twofold:

- One is to develop an experimental test setup, select test variables and demonstrate good experimental setup repeatability and reproducibility for a simple 3-point flexural test to evaluate the flexural strength of stacked die configurations.
- Another is to identify, compare, and differentiate plausible stack attributes that contribute to varying flexural strength of stacked die configurations. The determined flexural load range and corresponding flexural extension at predefined failure mode (initial fracture in die) would be used to relatively compare these die configurations and comment on the packages' mechanical robustness. Data captured would help resolve future die failure problems encountered in new packaging and process development work.