Smart fabrication system for MEMS by information sharing

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Abstract

Our research theme contributes to manufacturing efficiency and reducing greenhouse-gas emission by the following two development items, which will be beneficial at design phase;
A. Enhancement of information-sharing between design and testing processes for productivity growth.
B. Assessment and prediction of greenhouse-gas emission, particularly focused on production steps.

Introduction

In order to minimize environmental impact, environmentally-friendly design of products has been emphasized increasingly. We develops designing methods for manufacturing efficiency and reducing greenhouse-gas emission.

For manufacturing efficiency, a reverse-engineering method of MEMS devices is under development, by using the measurement of an X-ray CT scanner. Obtained information about defects and erratic patterns is fed back to designing.

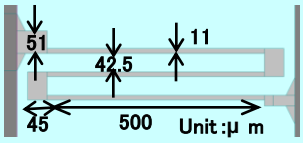
For reducing greenhouse-gas emission, methods for assessment and prediction of greenhouse-gas (GHG) emission in MEMS device production are under investigate. Estimation about GHG emission is fed back to or utilized in designing.

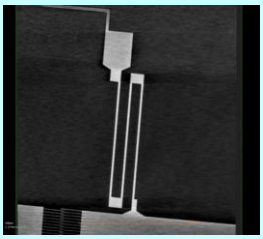
By these information, the design of device and process, and process condition are renewed for improving a yield rate and for reducing GHG emission.

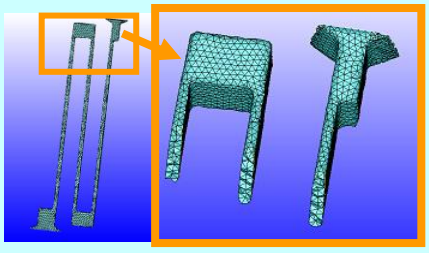
→ **Environmentally Friendly Design**

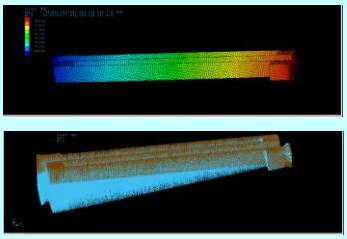
MEMS reverse engineering

A MEMS device is measured by an X-ray CT scanner. Then, a 3D model is made from the CT volume obtained by the measurement. The 3D model is a tetrahedral meshed CAE model. The structural analysis is conducted using the CAE model. Finally, the analysis result using the tetrahedral mesh form CT scanning and the analysis result using the CAD model are compared for inspecting defects and erratic patterns.









Volumetric data → Triangulated mesh → Tetrahedral mesh → Structural analysis

Assessment and prediction of GHG emissions

Equivalent CO2 (CO2e) emission in MEMS-device production is estimated by summing up all emissions over processes for single lot, e.g. a wafer. Activities causing emission include producing electric power, materials, and consumables; supplying utilities; and processing emitted wastes in each process. The process-level estimation enables to build emission models for each process, and then makes it possible to utilize prediction of CO2e emission at design phase.