Southwest Center for Microsystems Education (SCME)
University of New Mexico

MEMS Micromachining Overview Learning Module

This learning module contains the following:
Knowledge Probe (KP) or Pre-test
Primary Knowledge (PK)
Terminology Activity
Research Activity
Final Assessment

A Learning Module Map is included as a suggested outline on how to use this learning module.

This learning module provides an overview of three micromachining processes (bulk, surface, LIGA) used for the fabrication of microsystems or MEMS (microelectromechanical systems). Activities are provided that contribute to a better understanding of these processes and that encourage further exploration.

Target audiences: High School, Community College, Universities

Made possible through grants from the National Science Foundation Department of Undergraduate Education #0830384, 0902411, and 1205138.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and creators, and do not necessarily reflect the views of the National Science Foundation.

Website: www.scme-nm.org

Learning Module Map for MEMS Micromachining Overview

This learning module provides an overview of three micromachining processes (bulk, surface, LIGA) used for the fabrication of microsystems or MEMS (microelectromechanical systems). Activities are provided that contribute to a better understanding of these processes and that encourage further exploration.

Learning Module contains five units plus an additional set of activities for LIGA:

- Knowledge Probe (KP) - Pretest
- MEMS Micromachining Overview Primary Knowledge (PK)
- Terminology Activity
- Research Activity
- LIGA Activities (See NOTE)
- Final Assessment (a short answer and multiple choice version included)

NOTE: There are four (4) LIGA Activities that can be used to support the LIGA portion of this learning module. Two of these activities are supported with a SCME kit that can be requested through the SCME website while supply lasts and the center is funded. The four LIGA activities consist of a research activity, a LIGA simulation of lithography and electroplating (Part I and II), and a terminology activity. The LIGA activities are grouped together in a supporting module.

Following is a suggested map on the implementation of this learning module.

IMPORTANT STEPS	KEY POINTS	REASONS
Pre-test: Have the participants complete the Knowledge Probe (KP)	The KP contains questions about the processes discussed in this learning module and assesses what the participants may already know.	This KP stimulates the participants' thinking on this subject as well as provides the instructor with an idea of what the participants may or may not already know.
Unit Presentation: Present the MEMS Micromachining Overview PK	Participants should read the PK. A PowerPoint presentation can be downloaded from scme-nm.org and presented to all participants.	An introduction into most widely used micromachining methods will lead to more effective learning in the related activities.

Activity 1: Complete the "MEMS Micromachining Terminology Activity".	This is a crossword puzzle of micromachining terms and their meanings. This activity could be a homework or classroom assignment. There is also an on-line version available through SCME.	Provides participants with a review of the terminology associated with three widely used MEMS micromachining methods: surface, bulk and LIGA.
Activity 2: Complete the "MEMS Micromachining Research Activity".	This is a research activity in which participants study and outline the fabrication process of a specific microcomponent.	This activity allows participants to further explore the various micromachining methods. Participants gain more insight into the types of MEMS fabricated under each method and into the specific process steps.
LIGA Activities	These four activities are found in another learning module: LIGA Micromachining Activities	A SCME kit is required to complete 2 of the 4 activities.
LIGA Research Activity Complete the LIGA Research Activity	This activity allows students to further explore LIGA micromachining and its process steps.	Further exploration of LIGA demonstrates the growing importance of LIGA in MEMS fabrication.
LIGA Micromachining Simulation – I and II This simulation requires the SCME kit: *LIGA Micromachining: Lithography & Electroplating*	Order the kit through the SCME website while supply lasts (http://scme-nm.org)	These activities provide a hands-on opportunity to simulate the LIGA processes of lithography and electroplating.
LIGA Micromachining Terminology Activity Complete this terminology activity	This is a crossword puzzle of LIGA terms and definitions. This activity could be used as an in-class or out-of-class assignment.	Provides participants with a review of the terminology associated with LIGA micromachining.

Assessment: Complete the Final Assessment.		Participants are evaluated on what they have learned about MEMS micromachining, the advantages and disadvantages of each, and the types of MEMS fabricated using each method.

Support for this work was provided by the National Science Foundation's Advanced Technological Education (ATE) Program through Grants. For more learning modules related to microtechnology, visit the SCME website (http://scme-nm.org).