**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

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Southwest Center for Microsystems Education (SCME) NSF ATE Center

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Website: [www.scme-nm.org](http://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**.

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| **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. |

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