

Idaho Incubation Fund Program

Progress Report Form

Proposal No. IF16-003
Name: Peter Mullner
Name of Institution: Boise State University
Project Title: Solid State Positioning Device
Reporting Period: January 1, 2016 to June 30, 2016

Information to be reported in your progress report is as follows (attach additional information as needed):

1. Summary of project accomplishments for the period just completed and plans for the coming reporting period:

We have designed, built and tested an electrical actuation device. The device produces locally concentrated, pulsed magnetic fields of up to 300 mT with 0.2 kHz actuation frequency. These parameters are sufficient to drive twin boundaries in Ni-Mn-Ga.

We then applied the device to an MSM element and demonstrated twin-boundary motion (Figure 1).

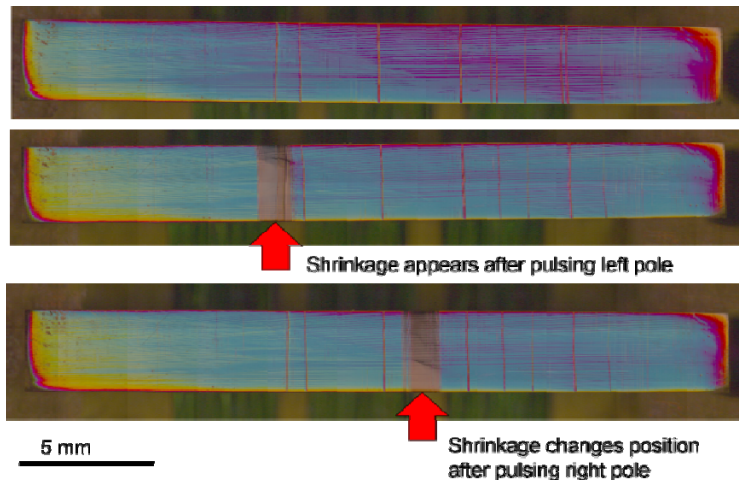
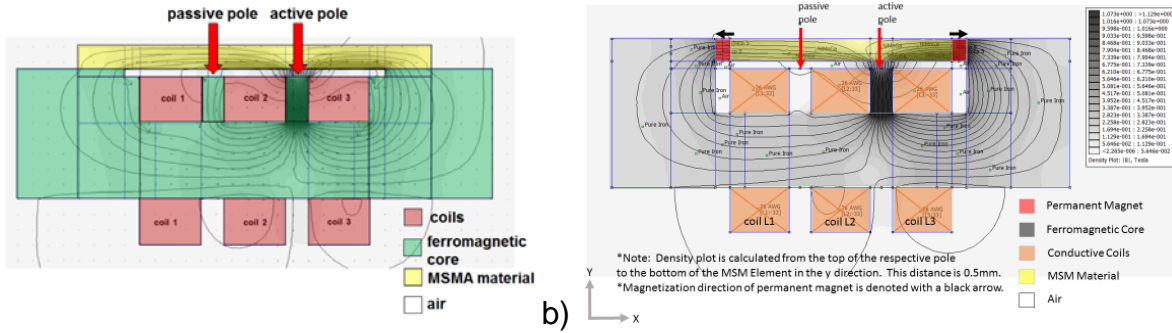


Figure 1: Demonstration of twin boundary motion in an MSM element driven by electrical actuation device.

We modelled the MSM solid state drive system with a commercial finite element analysis software (Figure 2a). The results are consistent with the experimentally measured magnetic fields at the pole pieces. We further modified the design of the system by including permanent magnets. The corresponding finite element analysis (Figure 2b) demonstrates that the system with permanent magnets can be driven with much reduced electrical current. We submitted a project proposal for funding of a second project phase which was funded.



a) Figure 2: Finite element analysis models for the solid state drive systems (a) without permanent magnets and (b) with permanent magnets.

2. Summary of budget expenditures for the period just completed (include project burn rate):

The expenses are summarized in Table 1.

Expense category	Amount
Salary regular	\$ 26,469.75
Student salary	\$ 25,132.79
Fringe	\$ 9,770.62
Other expense	\$ 12,626.84
Travel	\$1,000
Total	\$ 75,000

3. Numbers of faculty and student participation resulting from the funding, including internships:

- Dr. Peter Mullner
- Dr. Paul Lindquist
- Andrew Armstrong (MSE graduate student)
- Sam Barker (ME undergraduate student)
- Miranda Buttram (MSE undergraduate student)
- Justina Freilich (MSE undergraduate student)
- Eric Rhoads (ME undergraduate student)

4. List patents, copyrights, plant variety protection certificates received or pending:

The following patents are pending:

“Electrically driven magnetic shape memory apparatus” (BSU file 158)

“Magnetic shape memory apparatus with long stroke” (BSU file 169)

“Permanent-magnet-assisted electrically driven magnetic shape memory apparatus”
(BSU file 188)

5. List technology licenses signed and start-up businesses created:

On November 19, 2015, Shaw Mountain Technology LLC licensed Boise State’s patent US 9,091,251 *Actuation method and apparatus, micropump, and PCR enhanced method*.

6. Status of private/industry partnerships (include enough information to judge level of engagement):

Effective January 20, 2015, Dr. Mullner registered Shaw Mountain Technology LLC (SMT, <http://www.shawmountaintechnology.com>) with the State of Idaho. SMT is a Boise-based company that produces high-quality, advanced technology. SMT’s priority is to keep product development, manufacturing and company operations located within Idaho. SMT specializes in shape memory alloys, particularly the magnetic shape memory alloy Ni-Mn-Ga, and develops various technologies within the fields of sensors, microfluidics, energy harvesters and actuators.

Starting in August 2015, SMT sponsors a senior design project at Boise State’s College of Engineering. The students are tasked to develop a self-resting power breaker based on magnetic shape memory alloys.

SMT licensed Boise State technology (BSU files 90, 96, 122, see paragraph 5) and considers licensing technology developed in this project.

7. Any other pertinent information that will indicate to the council that the project is meeting satisfactory progress.

SMT is interested in partnering on this project during FY 2017.