

Smart Magnetic Films

Since 1996, Energen's expertise in magnetic "smart" materials has enabled innovative shape and vibration control solutions for the aerospace and high-energy physics communities. Developed in part through the SBIR program, Energen actuators and linear motors are being applied successfully to diverse applications such as precision positioning of telescope optics, active vibration and jitter control of weapons platforms, and tuning of particle accelerator cavities. Through these endeavors, Energen has developed a set of core competencies in magnetic smart materials that has the potential to deliver quantum jumps in performance beyond the markets in which the company currently participates.

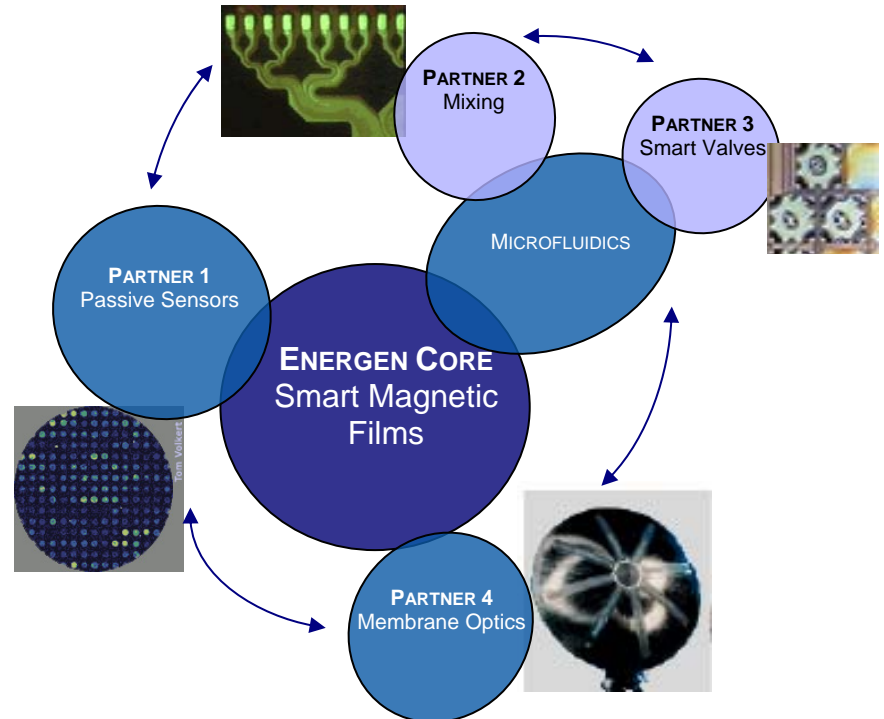
Having proven the value of smart magnetic materials on the macroscale, the company is now embarking on an ambitious program to exploit the commercial potential of magnetic smart materials in thin film form. These smart magnetic films can be engineered to have the following compelling properties:

- Selective actuation without physical contact
- Low voltage operation
- Ability to generate high force motion
- Compatibility with flexible substrates
- Ability to retain shape until actively reversed

Application Potential

The application potential of smart magnetic films is broad, addressing a range of length scales and industries. For example, by depositing them on passive chips with no power source, one could enable cheap, disposable multi-agent detectors for chemicals or bio-toxins that can be worn like a button by humans. The sensors might consist of an array of micro-reservoirs, each with a selectively actuated "cover". In use, the buttons are distributed to personnel with selected covers opened for sampling, then closed at some collection point to allow processing at a later time. Since the actuation mechanism is a separate device, these chips can potentially be made very compact and inexpensive.

In microfluidics, Energen's technology could be applied to flow control and mixing. By developing valves based on smart magnetic films, one is freed from bulky pressure manifolds and the design constraints imposed by electrostatic valves. For mixing, one can envision coating channel walls with smart films and controlling flow rate by actively changing channel widths. By alternately constricting portions of a channel using a smart film, new, better and faster fluid mixing methodologies may be devised.



Shape control of extremely large deployable space apertures is an example of a magnetic smart films application in a completely different field and length scale. Airborne and space-deployable structures consist partly of polymer membranes and are combined ideally with a conformal low-mass actuation and feedback mechanism that can monitor shape and change it actively. Examples include solar sails, transmitting antennas, reflectors, and optical mirrors. The promise of being able to set membrane shapes on earth, package the devices, and deploy them passively without losing the set shapes is immensely exciting to a community whose highest level goals are low mass and low cost.

Laying the Foundation

In order to achieve our goals, we have devised a strategy of distributing our core competency development. We seek partnerships with academic institutions, national laboratories, government agencies, and industry to pursue application-specific opportunities in the partner's market niche. In addition to solving the partner's specific problem, each of these programs enables us to develop one or more common elements that are key to our knowledge base. In return, partners leverage their resources by gaining access to the common underpinnings of a broad range of R&D. Energen has a proven track record of delivering high performance, cost effective solutions based on our core technologies. Cross-disciplinary collaborations deliver innovative solutions with growth potential not only in the areas described, but in many others not yet envisioned.