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Shape Memory Effect Metal Foams for High Power Density Actuators

By Peter Jardine, Ph.D

President of Shape Change Technologies

Oct 20, 2016

Pizza 6:30 pm – Talk at 7:00 pm

Please register here

La Reina High School, 106 West Janss Road, Thousand Oaks, CA

The Shape Memory Effect (SME) in certain metals are due to phase transformations that occur when the material is heated or cooled through a set of transformation temperatures. One SME alloy in particular, Nitinol, has seen as great deal of interest as these transformation temperatures can be modified easily by small changes to the Ti:Ni ratio and by the introduction of dopants, making them suitable for both industrial and biomedical applications.

With recovery forces of approximately 64 KSi, the forces that small diameter SME Nitinol wires can generate can be large, for example a 0.020" diameter Nitinol wire can lift a 20 lb weight. However, as force requirements increase, the thickness of the SME wire must increase, increasing the cycle time of the actuator. For very large torque or force requirements, cycle times are several minutes, making them unsuitable for a large number of applications.

Shape Change Technologies has pioneered the manufacture of open-celled Nitinol foams, where large force and torque actuators are built as large, net-shape articles. The strut size of the foams is small, so that the thermal cycling time is on the order of several seconds, dramatically increasing the power exerted by the actuator over conventional solid Nitinol actuators.

The materials science of foam generation will be discussed as well as the typical properties of the foam for both actuation and shock mitigation. Several examples of how the foam is now being used for converting waste heat into mechanical power will be discussed.

Our Guest Speaker:

Dr. Peter Jardine is interested in the development of shape memory materials and forms, focusing on applications in alternative energy, actuator systems and medicine. Jardine was Chief Technology Officer to a Hydrogen sensor and fuel cell company and for 16 years, president of Shape Change Technologies. Jardine has over 33 years of experience in Shape Memory Alloys device design, with demonstrated products in SMA actuators, including both high torque output 3600 in.lb torsional actuators and low force, high frequency thin film TiNi MEMS devices. These developments then led to their integration into concepts such as thin film TiNi heart valves (medicine), heat engines (alternative energy) and fast, TiNi foam actuators. Other SMA concepts taken to demonstration include Vacuum shutters and fluid pumps. Jardine has also developed synthesis techniques for thin film materials and for TiNi porous materials from elemental powder compaction. Jardine has over 40 technical papers on Shape Memory Effect Related projects.

Jardine also serves on SBIR review panels for the National Institute of Health and is an active member in CASMART, an alliance of federal government, industry and academia aimed at advancing the field of Shape Memory and Superelastic materials.

Location

La Reina High School
106 W. Janss Road,
Thousand Oaks, CA 91360

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