The Department of Materials Science and Engineering invites you to join us for an upcoming Seminar:

Professor Matt Begley

University of Virginia
Departments of Mechanical Engineering and MSE

Talk Title: **Processing-Structure-Property Relationships**

in Nano-porous Metal Thin Films

Date: Monday, March 9

Time: 4:00 to 5:00 PM

Refreshments: 3:30 to 4:00

Room: Wilsdorf 101

Abstract:

The first part of this talk will briefly answer the following question: if the marriage of materials science and engineering physics begins breeding intelligent microfluidic devices, what will these children look like? And, would they be attractive to the children resulting from the marriage of MEMS and biochemistry? Using an illustrative case study [1], it will be argued that these four disciplines represent the grandparents of a future healthy population of miniaturized devices that will revolutionize bioanalytical diagnostics.

The second part of this talk will address the following question: does the utility of nano-porous metals extend beyond the procurement of NSF funding? (Or alternatively, do nano-porous metals represent useful progeny of the aforementioned grandparents, or simply a deadbeat child?) The answer requires more scientific questions, which will be discussed: what *are* the properties of nano-porous gold? How are these properties controlled through processing? What are the processing steps that lead to microdevices with desirable properties? What are potential applications of these devices?

Partial answers to these questions will be described using several case studies involving experiments and models: (*i*) the relationship between processing, material structure, and properties in microfabricated nano-porous metal devices [2-4], (*ii*) the transport of fluids and macromolecules in nano-porous gold [5], (*iii*) the electro-mechanical response of composites comprised of nano-porous gold and elastomer thin films [6]. These case studies will be used to suggest promising areas for future exploration of the science and technology associated with nano-porous metals.

[1] Leslie, D.C., Easley, C.J., Seker, E., Karlinsey, J.M., Utz, M., Begley*, M.R. and Landers*, J.P. Frequency-specific flow control in microfluidic circuits with passive elastomer features, *Nature Physics*, DOI: 10.1038/phys1196. (2009)

[2] Seker, E., Reed, M.L. and Begley, M.R. A thermal treatment approach to reduce the formation of microvoids in blanket nano-porous gold films, *Scripta Materialia*, **60**, 435-438. (2009)

[3] Seker, E., Gaskins, J.T., Zhong, J., Bart-Smith, H., Reed, M.L., Kelly, R., Zangari, G. and Begley, M.R. The effects of annealing prior to dealloying on the mechanical properties of freestanding nanoporous gold microbeams, *Acta Materialia*, **56**, *324-332*. (2008)

[4] Seker, E., Gaskins, J.T., Zhong, J., Bart-Smith, H., Reed, M.L., Kelly, R., Zangari, G. and Begley, M.R. (2008) The effects of annealing prior to dealloying on the mechanical properties of freestanding nanoporous gold microbeams, *Acta Materialia*, **56**, *324-332*. (2008)

[5] Seker, E., Begley, M.R., Reed, M.L., and Utz, M. and Kinetics of capillary wetting in nano-porous films in the presence of surface evaporation, *Applied Physics Letters*, **92**, 12138. (2008)

[6] Seker, E., Reed, M.L., Utz, M. and Begley, M.R. Flexible and conductive bilayer membranes of nano-porous gold and silicone: synthesis and characterization, *Applied Physics Letters*, **92**, 154101. (2008)