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Probing Interfacial Friction and Dissipation in Granular Gold Nickel Alloys with a Quartz Crystal Oscillator in an External Magnetic Field[1] K.M. STEVENS, J. KRIM, North Carolina State University — We present here a quartz crystal microbalance study of two-phase gold nickel alloys whose internal granular properties are probed by exposure to a fluctuating external magnetic field. The work is motivated by prior studies demonstrating that granular two-phase materials exhibited lower friction and wear than solid solution alloys with identical compositions [1]. In particular, we report a "flexing" effect which appears when an external magnetic field is applied, and is manifested as a decrease in the magnitude of oscillation amplitude that is synchronized with the applied field; the effect is not seen on the complimentary solid solution samples. The effect is consistent with internal interfacial friction between nickel and gold grains, indicating a degree of freedom which may decrease friction even in the absence of an external magnetic field. This is supported through analysis of energy dissipation in the system, using the Butterworth-Van Dyke equivalent circuit model [2]. Data and interpretation are also presented that rule out alternate explanations such as giant magnetoresistance [3] and/or other resistive phenomenon within the film.

[1] L. Pan, Ph.D. Thesis, NCSU (2011).
[2] R. Cernosek et al, IEEE Transactions Ultrasonics, 45 (5) 1998
[3] J. Xiao et al., PRL 68 (25) 1992

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