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High-precision study of time- and temperature-dependence of the elastic properties of ^{239}Pu B. MAIOROV, B.J. RAMSHAW, Los Alamos National Laboratory, A. SHEKHTER, National High Magnetic Field Laboratory, J.B. BETTS, F. FREIBERT, A. MIGLIORI, Los Alamos National Laboratory — It is important to determine the origin of changes in elastic properties in ^{239}Pu as a function of time. The measurement of mechanical resonance frequencies can be made with extreme precision and used to compute the elastic moduli without corrections giving important insight in this problem. The precision of these measurements enabled observation of changes in elastic properties of 1 part in 107 for measurements lasting hours up to several days. The most-likely source of these changes include a) ingrowth of radioactive decay products such as He and U, b) the introduction of radiation damage, c) phase instabilities associated with transformations to the delta phase or to Pu_3Ga. Using Resonant Ultrasound Spectroscopy, measurements were made of the mechanical resonance frequencies of 300mg cylinders of fine-grained polycrystalline alpha-phase ^{239}Pu with about 600PPM Ga. We present the surprising result that at temperatures below 60K, there is a strong dependence on temperature of the rate of change of elastic moduli with time. Older results showed that the sign of this rate of change reverses at higher temperature. Such studies of nascent state are key to exploring damage evolution and its impact on specific volume and elastic moduli. Future studies will continue these measurements to above ambient temperatures.

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