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The 50 K anomaly in the shear modulus of β-$PdH_{0.71}$ DOUGLAS SAFARIK, RICARDO SCHWARZ, Los Alamos National Laboratory — When palladium hydride, PdH_x, is rapidly cooled to liquid helium temperature and then slowly reheated, both the heat capacity and electrical resistivity show a peak in the range $50 < T < 80$ K, depending on the composition x. This "50 K anomaly" has been previously explained in terms of formation of long-range ordered hydrogen superlattice structures. However, several aspects of the 50 K anomaly are inconsistent with an ordering phase transition, namely, the temperature of the anomaly depends on the rate of cooling, and the magnitude of the anomaly is larger for a fast cooling rate than for a slow cooling rate. We have studied the 50 K anomaly by measuring the elastic constants of single-crystal $PdH_{0.71}$ in the temperature range $1.4 < T < 300$ K during both fast cooling and slow warming. During warming, we observed a peak in the shear modulus $C' = (C_{11}$ - $C_{12}/2)$ at 55 K, which we attribute to the 50 K anomaly. In contrast, we observed no peak in the temperature dependence of the shear modulus C_{44} or of the bulk modulus B. We propose that the 50 K anomaly arises not from the formation of long-range ordered hydrogen superlattice structures, but from freezing of the hydrogen short-range order as the hydride is cooled.

Douglas Safarik
Los Alamos National Laboratory

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