Direct evidence of spin-phonon coupling in multiferroic DyMn$_2$O$_5$ via magneto-infrared measurements$^1$ J. CAO, J. L. MUSFELDT, University of Tennessee, Y. J. WANG, National High Magnetic Field Laboratory, S. PARK, S.-W. CHEONG, Rutgers University — The infrared active phonons in multiferroic DyMn$_2$O$_5$ are investigated as a function of magnetic field and temperature. Both field-induced frequency shifts and oscillator strength redistributions are observed in three important modes (the $f$-manifold crystal field splitting of Dy$^{3+}$ near $\sim$150 cm$^{-1}$, the Mn-O bending mode at $\sim$270 cm$^{-1}$, and the Mn-O stretching mode near $\sim$630 cm$^{-1}$), indicating strong spin-phonon coupling in this material. The crystal field levels of Dy$^{3+}$ are weakly sensitive to temperature induced magnetic phase transitions, whereas the Mn-O bending and stretching modes are insensitive to these phase boundaries. These measurements provide direct proof of spin-lattice interactions in DyMn$_2$O$_5$.

$^1$This work is supported by the U.S. Department of Energy