Ultrasonics in the two-dimensional dimer spin system $YbAl_3C_3$

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We report results of sound velocity, *i.e.*, elastic constant measurements in the two-dimensional dimer spin system $YbAl_3C_3$. This system exhibits a clear phase transition at $T^* = 80$ K, evidenced by the specific heat and elastic constant measurements.[1] No significant anomaly, however, was observed in the magnetic susceptibility crossing T^*, suggesting a non-magnetic origin of the phase transition. Initially, a quadrupolar ordering scenario was proposed by our group. Since a reference system $LuAl_3C_3$ also exhibits the same phase transition confirmed by the specific heat measurement, it was commonly understood that a quadrupolar moment was not a primary order parameter below T^*. Instead, a dimer spin model was proposed then.[2] The longitudinal C_L and transverse C_T elastic constants of the poly crystal sample show a pronounced anomaly in sound velocity at low temperatures and in applied magnetic field. Below 1.5 K, these constants demonstrates a softening with increasing field close to the meta-magnetic transition field, $B_m \approx 7.5$ T. The ultrasonic results are analyzed with a theory based on magneto-elastic coupling. We can obtain good qualitative agreement between theoretical results and experimental ones.

[1]M. Kosaka *et al*, J. Phys. Soc. Jpn. **74**, 2413 (2005).
[2]A. Ochiai *et al*, J. Phys. Soc. Jpn. **76**, 123703 (2007).