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Effects of Annealing Cool-down Rate on Torque Transducer Response Function in 4340 High-Alloy Steel[1] BRYAN G. HECOX, JOSEPH L. WIEWEL, MARK S. BOLEY, Western Illinois University — We have investigated the change in magnetoelastic torque transducer response as the annealing cool-down rate is changed in 4340 high-alloy steel. In many commercial power-train applications, measurement of torque via a non-contact method is highly desirable. Three separate solid steel 1-inch diameter shafts underwent a common hardening process conducted in a helium atmosphere followed by a five hour annealing process at 843° C. Subsequently, the three samples were cooled down at rates of 10° C, 15° C, and 20° C, respectively. Prior and subsequent to heat treatment, the axial magnetic hysteresis properties of the samples were measured and their external field signals were mapped over the magnetically polarized regions both with and without torque (applied shear stress up to 3500 psi). The faster annealing cool-down rate increased the torque response (sensitivity) and the field map height the most. The heat treatment improved the Gaussian field map shape and removed the remnants of old domain walls. Linearity of response remained consistent before and after heat treatment.

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