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Determining Optimal Austenitizing and Tempering Temperatures and Quenching Media for a Steel Torque Transducer JOSEPH L. WIEWEL, CHRISTOPHER L. MILBY, MATTHEW W. BECKNER, MARK S. BOLEY, Department of Physics, Western Illinois University — In our laboratory we have developed a series of high-stress steel alloy magnetoelastic torque transducers that convert applied stress to an external magnetic field signal. We have found that linearity, repeatability, and sensitivity of these transducers is highly dependent on the heat treatment to which the steel is subjected, which is severely limited by the minimum hardness coefficients that will be required in the actual technological application such as in a power delivery shaft. In our study, we focused on cases where Rockwell hardness coefficients in the forties or low fifties are expected, using a steel alloy with low nickel and chromium content. Austenitizing temperatures varied from 775 to 870 Celsius, while tempering temperatures varied from 205 to 540 Celsius, all in a helium atmosphere. The quenching medium following the austenitizing and tempering processes varied between oil and water. The study showed that a tempering temperature around 425 Celsius resulted in the best linearity and re-zeroing capabilities (repeatability) of the transducers, also corresponding to the least hysteresis. Additionally, water quench reduced sensitivity as compared to oil quench at the same temperature.

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