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Size Effects on Magnetoelastic Sensitivity and Polarized Domain Wall Profiles in ESR-420 Steel MATTHEW W. BECKNER, Department of Physics, Western Illinois University, JASON T. ORRIS, MARK S. BOLEY TEAM — In earlier research in our laboratory, we have found that the 14% chromium stainless tool steel, ESR-420, is an excellent candidate for torque sensing applications. My work has focused on producing solid and hollow sensory shafts of diameters ranging from 18 mm down to 5 mm with subsequent heat treatment processes in order to enhance their magnetoelastic behaviors. After the measurement of torque load sensitivities, and axial and circumferential magnetic hysteresis parameters such as retentivity and coercivity, the technique of magnetic force microscopy (MFM) is used to more closely examine the center domain wall between the two circumferentially magnetically polarized regions in the torque sensor section of the shaft. By fitting the sequential MFM scans, we were able to directly measure the domain wall width and height for each sample and correlate these to sensor diameter and the other measured magnetic properties. Additionally, a direct correlation was observed between the total domain wall region area (product of width and height) and the torque load sensitivities.

Matthew W. Beckner
Department of Physics, Western Illinois University

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