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Design considerations for a high sensitivity Barkhausen Noise sensor NEELAM PRABHU GAUNKAR, ORFEAS KYPRIS, CAJETAN NLEBEDIM, DAVID JILES, Department of Electrical and Computer Engineering, Iowa State University — Barkhausen emissions are produced due to sudden changes in magnetization when a continuously changing magnetic field is applied to a ferromagnetic material. The emissions described as Barkhausen noise can be observed as voltage signals using induction sensors. Effective capture of these emissions with high level of precision depends on several parameters influenced by the sensor design. For the magnetization unit, amongst others, the critical parameters include the magnetic field produced by the magnetizing coils, core geometry, sensor-to-specimen coupling, choice of core material, core length and operating frequency. Similarly, for the sensing unit the optimal pick-up coil material and number of winding turns need to be optimized. Enhancing these parameters will lead to improved sensitivity, reproducibility and reliability of the detected Barkhausen emissions. Using finite element analysis, this study shows design considerations for optimizing these parameters in order to achieve high accuracy in detection and analysis of Barkhausen signals especially as a tool for magnetic non-destructive evaluation.

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