

## **Quantitative Non-Destructive Single-Frequency Thermal-Wave-Radar Imaging of Case Depths in Hardened Steels**

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Single-Frequency Thermal Wave Radar (SF-TWR) imaging was used to produce dynamic images of effective case depths from phase image frequency scans in AISI 9310 and Pyrowear 53 steels. SF-TWR, as a fast non-destructive testing (NDT) technique, was also compared with conventional photothermal radiometry measurements in these two types of steel samples using a 3-layer theoretical thermal-wave model. In this presentation, we will discuss a novel approach of SF-TWR imaging, combining a three-distinct-layer thermal-wave model and radial phase profiles to image mean-value case depths and their lateral non-uniform distributions which yielded quantitative images of case depths in the two hardened steels and exhibited very good correlation with standard Vickers measurements. The SF-TWR images further revealed strong inhomogeneities in the case depth thickness profiles, to be used as an important feedback to the heat-treating manufacturing industry toward the optimization of their case depth hardening process.