Hardness Depth Profiling by Photothermal Radiometry of Steel Mechanical Components in Vehicles

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Quality control of the performance of mechanical components subjected to hardness processing is a topic of fundamental importance in the automotive field. The lack of hardening may cause failures with serious repercussions. The industry and the companies responsible for the hardening processes as well as for quality control of the mechanical components are continuously seeking for improvements in the standard destructive tests performed by Vicker or Brinell durometers. In this paper, a new methodology based on photothermal radiometry (PTR) is introduced for NDT of steel mechanical components for vehicles [1-4]. Such a methodology is useful for a fast nondestructive and noninvasive inspection of the hardness depth profiles, of the effective hardening depth, and of possible lack of hardening. We describe here a PTR compact system, fully automatized with robotic arms to measure the hardness depth profile of S53CG steel samples. For the calibration of the system, we have applied a photothermal deflection technique to measure the thermal diffusivity of the S53CG steel, so to determine the hardness/thermal diffusivity anticorrelation curve. A thermal diffusivity change from 13 x 10^{-6} m^2/s (unhardened) to 9 x 10^{-6} m^2/s (at 300 HV) has been found. Preliminary results show accurate hardness profile reconstructions in comparison with the hardness measurements by the standard Vicker test.

References:

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