

Advances in Photothermal Depth Profiling in Hardened Steels: New Inverse Approaches to Improve the Profile Reconstruction

Roberto Li Voti^{C,S}, Grigore Leahu and Concita Sibilìa

Dipartimento di Scienze di Base ed Applicate all'Ingegneria, Sapienza Università di Roma, Roma, Italy

roberto.livoti@uniroma1.it

Quality control of the performance of mechanical components subjected to hardness processing is a topic of fundamental importance, both in the field of automotive and aerospace systems both for civil and military applications. The lack of cementation, the burns in the steels, and the decarburisations of the power gears, and the statoric and rotoric equipments may cause catastrophic failures with serious repercussions. The industry and the companies responsible for the hardening processes as well as for the quality control of the mechanical components are continuously seeking for improvements in the standard destructive tests performed by Vicker or Brinell durometer where one mechanical component is chosen for random testing. In the last years we developed a new PTR compact system, integrable with mechanized and robotic arms for industrial needs, which use a simple Ge lens for collecting the IR radiation from the sample to the detector. The inverse problem to reconstruct the diffusivity profile $D(z)$ from the PTR signal in the frequency domain $S(f)$ has been solved by using different inversion techniques. We present here some results on AISI9310 hardened steel gears where we compare the hardness profile reconstructions measured by Vicker test with the photothermal reconstructions obtained with different inverse procedures