

ASSESSMENT OF FATIGUE DAMAGE DEVELOPMENT USING THE ESPI SYSTEM

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Fatigue damage process developing in structural materials under long-term cyclic loading is still an unsolved problem of modern engineering [1]. Fatigue damage has a local character, and it is based on damage development leading to generation of cracks appearing around structural defects or geometrical notches. An identification of these areas and their subsequent monitoring requires a full-field displacement measurements performed on the objects surfaces [2]. Modern contemporary optical methods such as Digital Image Correlation (DIC) and Electronic Speckle Pattern Interferometry (ESPI) are suitable for such a purpose. Both methods enable capturing of displacement distributions, however, ESPI system is more precise.

This paper presents an attempt to use the ESPI system for monitoring of fatigue damage development in specimens made of the aluminide coated nickel super-alloys. The fatigue tests were interrupted several times in order to perform a static loading during which the optical measurements were performed. The result of fatigue tests with subsequent analysis of local strain changes during subsequent cycles are presented. A typical example is shown in Fig. 1.

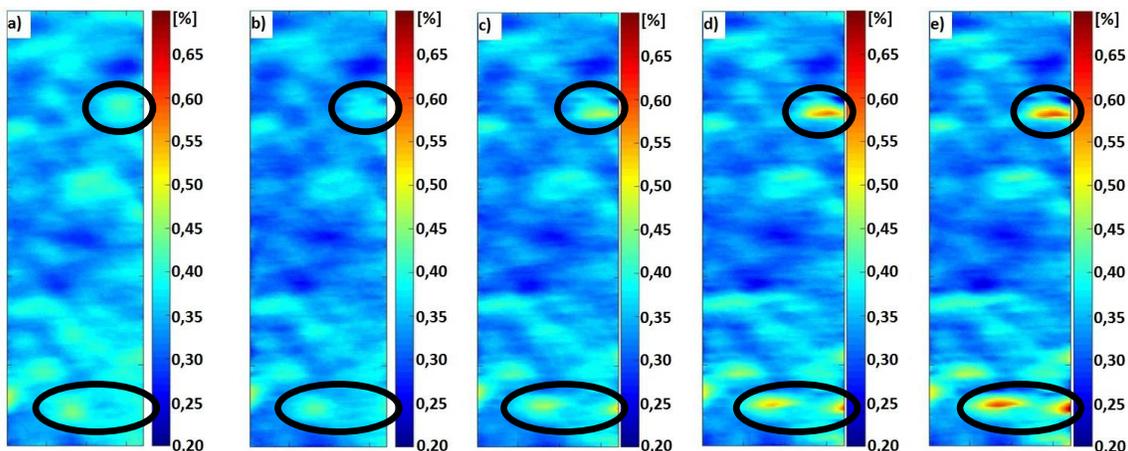


Fig. 1. The full-field strain distributions along the Y axis corresponding to the acting stress direction. Measurements are performed: (a) during the first cycle; (b) after 20000 cycles; (c) after 30000 cycles; (d) after 35000 cycles; (e) after 37000 cycles ($N_f = 39086$ cycle).

- [1] Kukła D., Kowalewski Z., Grzywna P., Kubiak K., Assessment of fatigue damage development in power engineering steel by local strain analysis, KOVOVE MATERIALY-METALLIC MATERIALS, ISSN: 0023-432X, Vol.52, No.5, 2014, 269-277
- [2] Grzywna P., Kukła D., Evaluation of strain distribution for the P91 steel under static load using ESPI system, ADVANCES IN MATERIALS SCIENCE, ISSN: 1730-2439, DOI: 10.2478/adms-2014-0019, Vol.42, No.4, 2014, 28-39