SPATIALLY RESOLVED DEPTH PROFILING OF RESIDUAL STRESS BY MICRO-RING-CORE METHOD

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Analysis and control of residual stresses in advanced engineering materials are important issues for reliability assessment at small scales, e.g. for micro-electromechanical systems (MEMS) and nano-crystalline and amorphous bulk and thin film materials. This presentation gives an overview of the recent advances in the field of sub-micron scale residual stress assessment by the use of focused ion beam (FIB)-controlled material removal techniques. Materials and The two step method consists of incremental FIB ring-core milling combined with high-resolution in-situ SEMFEG imaging of the relaxing surface and a full field strain analysis by digital image correlation (DIC). The through-thickness profile of the residual stress can be also obtained by comparison of the experimentally measured surface strain with finite element modelling using Schajer's integral method. In this presentation, we will review the most recent advances in the field of FIB-DIC methods for residual stress assessment at the micro and nano scales, with focus on recent efforts for development of automated procedures for local residual stress analysis of (i) thin films, (ii) microelectronics devices and (iii) polycrystalline and amorphous bulk materials.

Practical applications of the method on several systems will be described and discussed. In particular, the issues of residual stress assessment on very thin films and micro-devices, stress depth profiling, stress measurement on amorphous materials and the effects of ion induced damage and elastic anisotropy on the relaxation strains will be reviewed.