



Residual stress determination in oxidized bulk metallic glass using X-ray diffraction and FIB/DIC methods

Haratian, S.; Niessen, F.; Grumsen, F. B.; Villa, M.; Christiansen, T. L.; Somers, M. A. J.

Publication date:
2019

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Haratian, S., Niessen, F., Grumsen, F. B., Villa, M., Christiansen, T. L., & Somers, M. A. J. (2019). *Residual stress determination in oxidized bulk metallic glass using X-ray diffraction and FIB/DIC methods*. Abstract from 26th International Symposium on Metastable, Amorphous and Nanostructured Materials (ISMANAM 2019), Chennai, India.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

BOOK OF ABSTRACTS

ISMANAM-2019

**26th International Symposium on
Metastable, Amorphous and Nanostructured Materials**

July 8-12, 2019 | Chennai, India



Organized by

Dept. of Metallurgical and Materials Engineering

Indian Institute of Technology Madras

<https://mme.iitm.ac.in/ismanam2019>

CN-4

Residual stress determination in oxidized bulk metallic glass using X-ray diffraction and FIB/DIC methods

S. Haratian¹, F. Niessen², F. B. Grumsen¹, M. Villa¹, T. L. Christiansen¹ and M. A. J. Somers¹

¹*Materials and Surface Engineering Section, Mechanical Engineering Department, Technical University of Denmark, Kgs. Lyngby, Denmark*

²*Electron microscopy center, University of Wollongong , Wollongong NSW, Australia*

E-mail: Sahara@mek.dtu.dk

The presence of residual stresses inside the engineering components generated by local inelastic deformation can influence material's performance considerably during mechanical loading. Surface engineering of ZrCuAl-based bulk metallic glasses (BMGs) by low-temperature ($<T_g$) gaseous oxidizing is hypothesized to be possible in order to build-up compressive residual stresses in the surface region, which then results in decelerating the shear band propagation during deformation. In the current study stresses introduced as a consequence of ZrO_2 (Al_2O_3) formation on thermochemically oxidized $(Zr_{55}Cu_{30}Al_{10}Ni_5)_{98}Er_2$ BMG were investigated. For this purpose, conventional X-ray diffraction $\sin^2\psi$ and incremental core-ring focused ion beam (FIB) milling methods have been utilized. The BMG was initially oxidized in the controlled gaseous atmospheres imposing an extremely high pO_2 at 600 K for 60 hr. The residual stress $\sin^2\psi$ analysis was conducted on (011) reflection of the tetragonal- ZrO_2 peak where it reveals the existence of compressive stress in ZrO_2 . Surface strain relief monitored in high-resolution SEM imaging of a deposited stochastic pattern during gradual milling and measured by digital image correlation (DIC) also indicated the occurrence of compressive residual stresses in the surface region of the oxidized BMG.