



HAL
open science

Integration of Zr-V getter films in MEMS packaging

Sylvain Lemettre, Clément Bessouet, Charlotte Kutyla, Alain Bosseboeuf, Philippe Coste, Thierry Sauvage, Hélène Lecocq, Olivier Wendling, Aurelien Bellamy, Johan Moulin

► **To cite this version:**

Sylvain Lemettre, Clément Bessouet, Charlotte Kutyla, Alain Bosseboeuf, Philippe Coste, et al.. Integration of Zr-V getter films in MEMS packaging. 22nd International Vacuum Congress, Sep 2022, Sapporo, Japan. hal-03836067

HAL Id: hal-03836067

<https://hal.science/hal-03836067v1>

Submitted on 1 Nov 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Integration of Zr-V getter films in MEMS packaging

Sylvain Lemette¹, Clément Bessouet¹, Charlotte Kutyla¹, Alain Bosseboeuf¹, Philippe Coste¹,
Thierry Sauvage², Hélène Lecoq², Olivier Wendling², Aurélien Bellamy², Johan Moulin¹

¹C2N Nanored, Centre de Nanosciences et de Nanotechnologies, Université Paris-Saclay,
CNRS, UMR 9001, 91120 Palaiseau, France.

²CEMHTI, Conditions Extrêmes et Matériaux : Haute Température et Irradiation,
CNRS, UPR 3079, 45071 Orléans Cedex 2, France.

Films of Ti-Zr-V were extensively studied for their use in Ultra-High Vacuum (UHV) systems like particle accelerators since the end of 20th century [1]. The conditions of activation of a getter in a MEMS packaging and in a particle accelerator are very different [2]. This could explain why in MEMS vacuum packaging, the most used getters are Ti and Zr-Co-RE and the use of Ti-Zr-V was never reported. Thus we investigated the usefulness of the Zr-V films for MEMS packaging.

Films of Zr-V with various Zr content were co-evaporated on square silicon samples and on silicon MEMS caps. Films with high and low Zr content are nanocrystalline, while others are amorphous, as characterized by TEM. First the square samples were annealed under argon with traces of oxidizing gases at temperatures ranging from 200 °C to 400 °C and their oxygen content was measured by Nuclear Reaction Analysis (Fig. 1). Secondly the caps were sealed with a MEMS sensor at 300 °C under high vacuum and the resulting internal pressure inside the micropackages was measured by the quality factor of the MEMS and Residual Gas Analysis (Fig. 2). In both experiments, the Zr₈₅V₁₅ nanocrystalline film exhibited the best sorption performance compared to the Zr₅₀V₅₀ and Zr₃₀V₇₀ amorphous films.

These results show the interest of using Zr-V getter for MEMS packaging and the existence of an optimum of sorption performance between nanocrystalline and amorphous film microstructure.

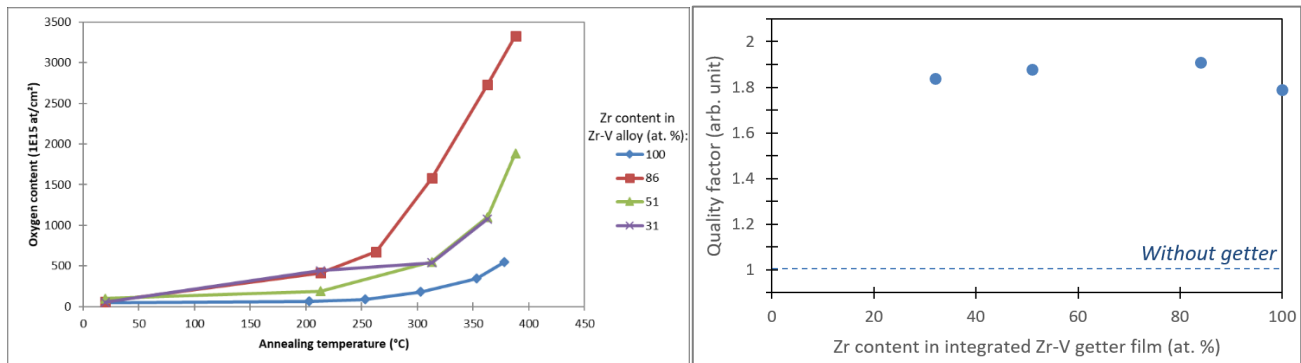


Fig. 1 (left): Oxidation of annealed films; Fig. 2 (right): MEMS quality factor packaged at 300 °C

References:

[1] C. Benvenuti et al, Vacuum 60 (2001) 57-65

[2] A. Bosseboeuf et al, Sens. Mater., Vol. 31, No. 9, 2019, p. 2825-2849