



Pyrolytic carbon for MEMS string resonantors

Nguyen, Quang Long; Larsen, Peter Emil; Boisen, Anja; Keller, Stephan Sylvest

Publication date:
2018

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):

Nguyen, Q. L., Larsen, P. E., Boisen, A., & Keller, S. S. (2018). *Pyrolytic carbon for MEMS string resonantors*. Abstract from International Conference on Expanding Frontiers of Carbon MEMS, San Diego, United States.

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.

Pyrolytic carbon for MEMS string resonators

Long Nguyen Quang^{1,2}, Peter Emil Larsen^{1,2}, Anja Boisen^{1,2} and Stephan Sylvest Keller^{1,2}

¹ Department of Micro- and Nanotechnology, Technical University of Denmark, 2800, Kgs. Lyngby, Denmark.

² DNRF and Villum Fonden Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics, IDUN, Technical University of Denmark, 2800, Kgs. Lyngby, Denmark

In order to achieve high resonance frequencies and quality factors of pyrolytic carbon MEMS string resonators the resonator material needs to have a large tensile stress. In this study, the influence of pyrolysis temperature, dwell time and ramping rate on the residual stress in thin pyrolytic carbon films is investigated with the bending plate method. The results show that the pyrolysis temperature is the most important parameter for tailoring the residual stress, with a transition from tensile stress at temperature below 800°C to compressive stress at temperatures above 800°C. Two kinds of photoresist: positive (AZ5214E) and negative (SU-8) and different pyrolysis conditions are used to fabricate pyrolytic carbon string resonators at variable pyrolysis conditions. The best performance is obtained for devices with a length of 400 nm fabricated at a pyrolysis temperature of 700°C, ramping rate of 30°C/min and 10 min dwell time corresponding to the conditions for maximum tensile stress in pyrolytic carbon thin films. The optimized pyrolytic carbon string resonators have resonant frequencies above 300 kHz and quality factors (Q) in the order of 10^4 , which is suitable for their application as nanomechanical sensors. One of these application is that using the nanomechanical infrared spectroscopy (NAM-IR) based on the photothermal response of a nanomechanical resonator, which enables the chemical analysis of picograms of analyte in only a few minutes.

