

Supplementary Information for
Measurement of volume changes and associated stresses in Ge electrodes due
to Na/Na⁺ redox reactions

Subhajit Rakshit,² Akshay S. Pakhare,¹ Olivia Ruiz,³ M. Reza Khoshi,⁴
Eric Detsi,³ Huixin He,⁴ Vijay A. Sethuraman,^{5,6} Siva P.V. Nadimpalli^{1,2,*}

¹Department of Mechanical Engineering,

Michigan State University, East Lansing, Michigan, 48824, USA

²Department of Mechanical and Industrial Engineering,

New Jersey Institute of Technology, Newark, New Jersey 07102, USA

³Department of Materials Science and Engineering,

University of Pennsylvania, Philadelphia, Pennsylvania, 19104, USA

⁴Department of Chemistry,

Rutgers University, Newark, New Jersey, 07102, USA

⁵Department of Chemical Engineering,

University of South Carolina, Columbia, South Carolina, 29208, USA

⁶Faraday Laboratory LLC, Columbia, South Carolina, 29201, USA

*Corresponding author: E-mail: sivan@msu.edu

Tel: +1 517 432 2976, Fax: +1 517 353 1750

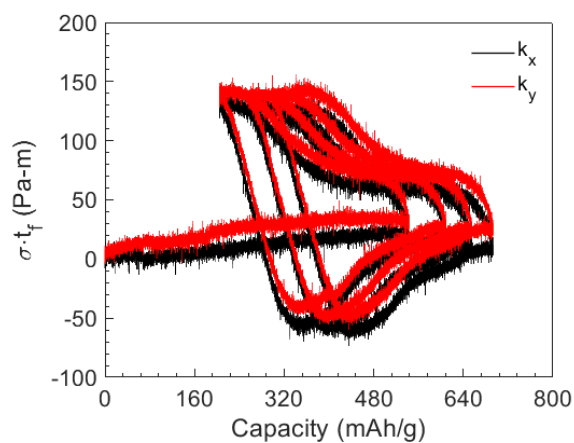


Fig. (S1). Variation of stress-thickness value (which is proportional to substrate curvature) as a function of capacity for two different in-plane directions (orthogonal to each other) K_x and K_y . A close matching between K_x and K_y indicates isotropic expansion of the ~ 100 nm a-Ge thin film during sodiation/desodiation reactions.

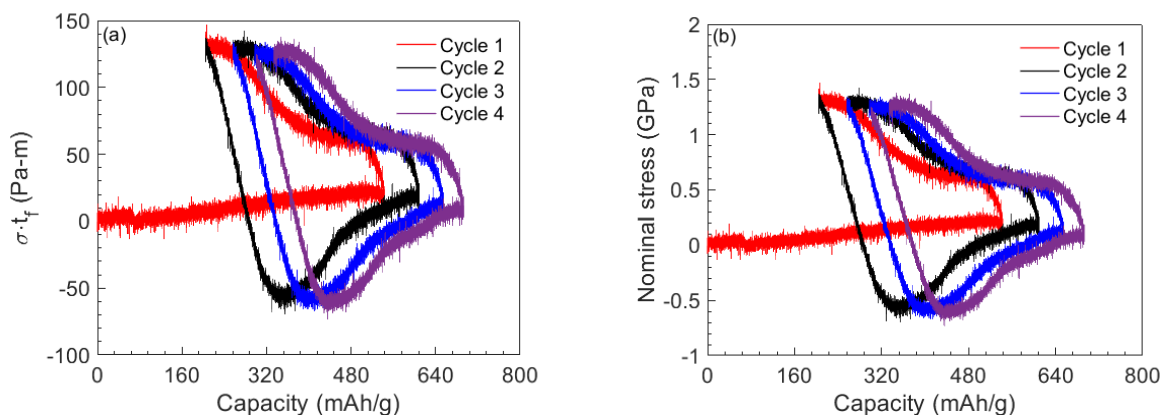


Fig. S2. Variation of (a) stress-thickness value (which is proportional to substrate curvature) and (b) nominal stress as a function of cell capacity of 100 nm a-Ge thin film upon sodiation/desodiation.

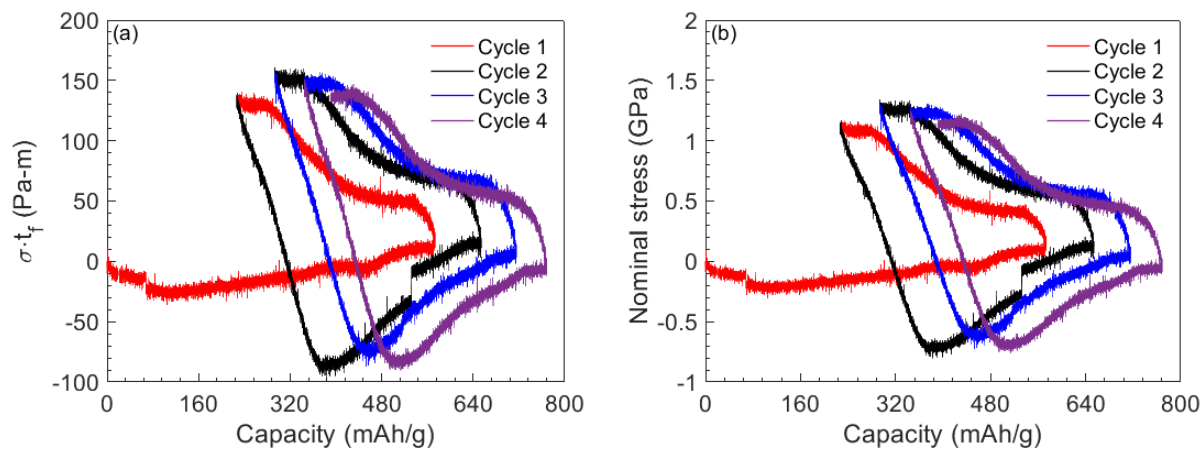


Fig. S3. Variation of (a) stress-thickness value (which is proportional to substrate curvature) and (b) nominal stress as a function of cell capacity of 120 nm a-Ge thin film upon sodiation/desodiation.

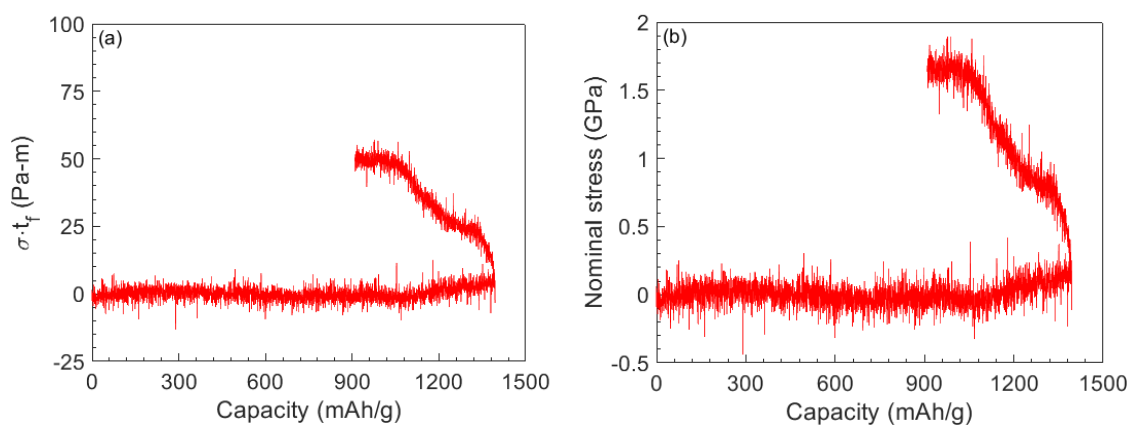


Fig. S4. Variation of (a) stress-thickness value (which is proportional to substrate curvature) and (b) nominal stress as a function of cell capacity of 30 nm a-Ge thin film upon sodiation/desodiation.