One-pot synthesis of flexible hydrophobic silica-based aerogel: excellent thermal stabilities and durable cyclic mechanical properties

Zhiyang Zhao, Xing Jiang, Yong Kong[1], Xiaodong Shen[2]
College of Materials Science and Engineering, Nanjing Tech University, Nanjing

Abstract: Flexible aerogels always focused on their excellent mechanical properties or functional development; unfortunately, their thermal stability was accidentally omitted, and the effect of heat treatment to the chemical groups and mechanical properties was seldom reported. Herein, a facile one-pot synthesis strategy to prepare flexible hydrophobic silica-based aerogel (FHSA) with an ambient pressure drying method. MTMS and DMDMS were choicely selected as co-precursors and formed a self-reinforcing strong skeleton. The morphology, microstructure, pore structure and elemental composition of the FHSA was characterized. Particularly, the effect of heat treatment to the chemical groups and mechanical properties was especially investigated. The as-prepared FHSA exhibited integrated properties of tunable densities from 0.047~0.127 g·cm^{-3}, wide temperature range of hydrophobicity from -196°C to 400°C, ultralow thermal conductivity (0.024W/m^{-1}·K^{-1}) at room temperature, as well as excellent mechanical performance with the ~80% reversible deformation, and exhibited excellent stabilities within 100 multi-compressive cycles, indicating that they can be perceived as promising candidates for the next-generation thermal insulation materials in some certain extreme environments.

Keywords: silica aerogel; flexible; hydrophobic; thermal stability; mechanical property

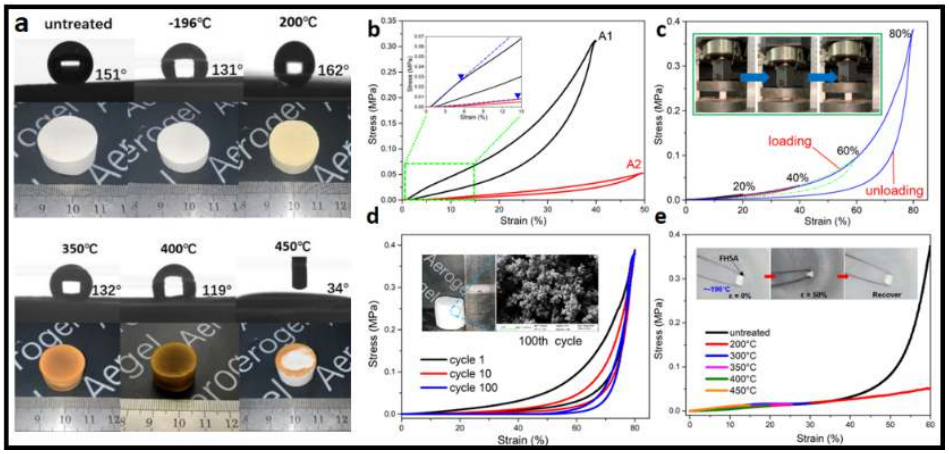

Fig. 1 (a) Water contact angles (b) σ-ε curves (c) σ–ε curves with increasing ε (d) multi-cycle compressive test and (e) σ–ε curves of different temperatures of FHSAs.

References:

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[1] **Corresponding author:** Yong Kong, E-mail: ykong@njtech.edu.cn.
[2] **Corresponding author:** Xiaodong Shen, E-mail: xdshen@njtech.edu.cn.