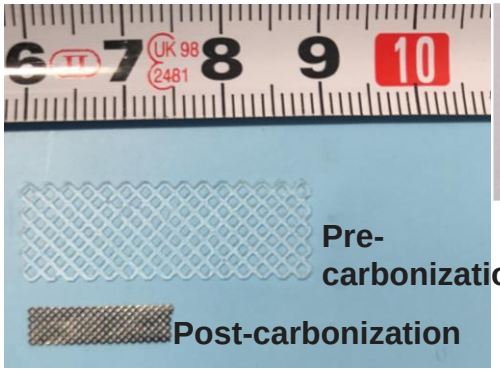
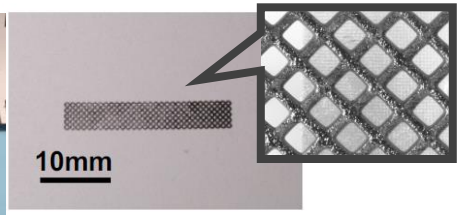
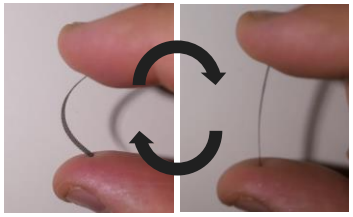
Tohoku Univ. Technology

2D carbon microlattice

Flexible carbon material







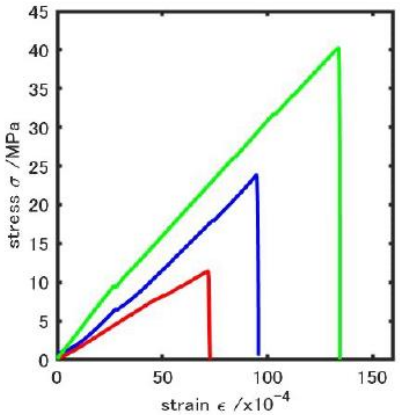
Overview

The stereolithographic 3D printer can mold various three-dimensional microlattice structures (3D microlattices) using a photocurable resin. When it is heat-treated in an inert atmosphere, the 3D carbon microlattice can be obtained by shrinking and carbonizing 60~80% while retaining its original shape. [1] [2]

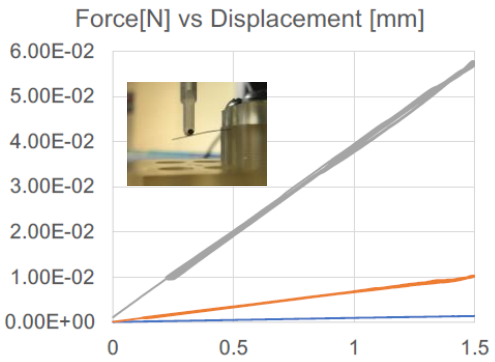
Although 3D carbon microlattices are lightweight and strong, they are difficult to flexibly deform like carbon fibers. In order to make microstructured carbon materials more widely applicable, in the present invention, a flexible carbon thin film was prepared by the same method as described above. Compared with 3D structures, 2D structures are more difficult to handle because they are prone to distortion, wrinkling, warping and bending after printing and carbonization. In the present invention, a reproducible fabrication method has been developed and completed as a “2D carbon microlattice, ” an all-carbon thin film material that flexibly bends while possessing carbon-derived mechanical properties, electrical conductivity and chemical stability.

Unlike carbon thin films [3] [4], which are prepared by chemical vapor deposition, etc., they can stand on their own without any foundation, and their various properties can be adjusted by the design of the lattice structure and the film thickness (70~150 μm). They can be applied to components of products requiring flexibility, strength and durability, such as wearable devices and mechatronics.

Features・Outstandings



↑ Tensile test results
（Green: Thickness 0.10mm,
Blue: Thickness 0.08mm,
Red: Thickness 0.07mm）



↑ Cantilever beam reciprocating bending test results
（Gray：Thickness 0.15mm,
Red: Thickness 0.11mm,
Blue: Thickness 0.07mm）

Product Application

- Electrodes that require flexibility and strength, such as wearable devices
- Electrodes that require chemical and biochemical stability, such as skin adhesive sensors
- Mechatronic spring components that operate at high temperatures and energized heating heaters

Related Works

[1] Kudo et al. ***Commun. Matter.*** 1 72 (2020)
[2] Kudo et al. ***Front. Mater.*** 6 169 (2019)
[3] Niemczyk et al. ***Appl. Surf. Sci.*** 576 151872 (2022)
[4] Yang et al. ***AIP Adv.*** 6 055310 (2016)

IP Data

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