Supporting Information

Honeycomb Scaffolds Fabricated Using Extrusion Molding and Sphere Packing Theory for Bone Regeneration

Koichiro Hayashi* and Kunio Ishikawa

Department of Biomaterials, Faculty of Dental Science, Kyushu University
3-1-1 Maidashi, Higashi-ku, Fukuoka 812-8582, Japan

Corresponding author: Koichiro Hayashi; E-mail: khayashi@dent.kyushu-u.ac.jp; orcid: 0000-0002-3147-5784

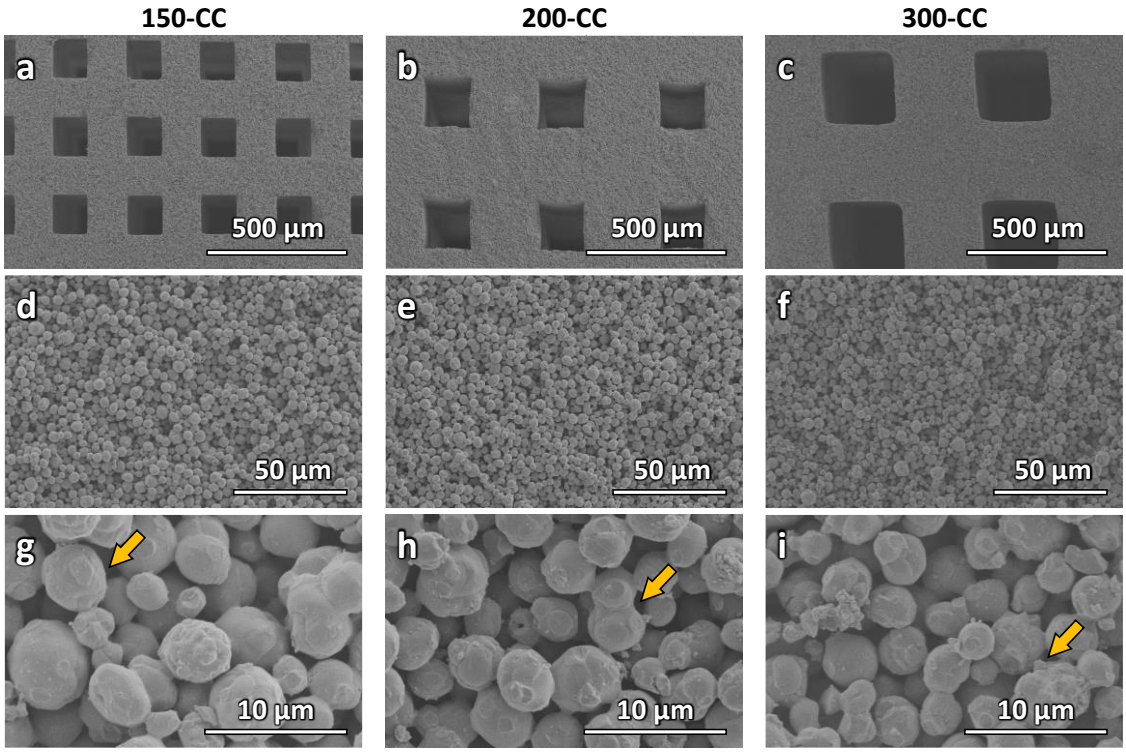

Figure S1. SEM images of (a) 150-CC, (b) 200-CC, and (c) 300-CC. (d–f) Magnified views of the panels shown in a–c. Magnified views of the struts of the (g) 150-CA, (h) 200-CA, and (i) 300-CA. The yellow arrows indicate micropores between spherical $CaCO_3$ aggregates.

Surface roughness and pore size distribution

Honeycomb GBs were extruded at 20–50 MPa pressure. The surface roughness of a strut in a honeycomb scaffold is not accurately measurable due to the influence of convexo-concave shapes derived from honeycomb structure. Therefore, we fabricated CO_3Ap samples by compacting spherical aggregates composed of $CaCO_3$ crystals at 20 and 50 MPa pressure followed by dissolution and precipitation to evaluate the surface roughnesses of these samples. Surface roughness was measure by laser scanning confocal microscopy (VK-9710, Keyence, Japan). Pore size distributions of CO_3Ap honeycombs prepared by extrusion at 20 MPa and 50 MPa were determined by mercury intrusion porosimetry.

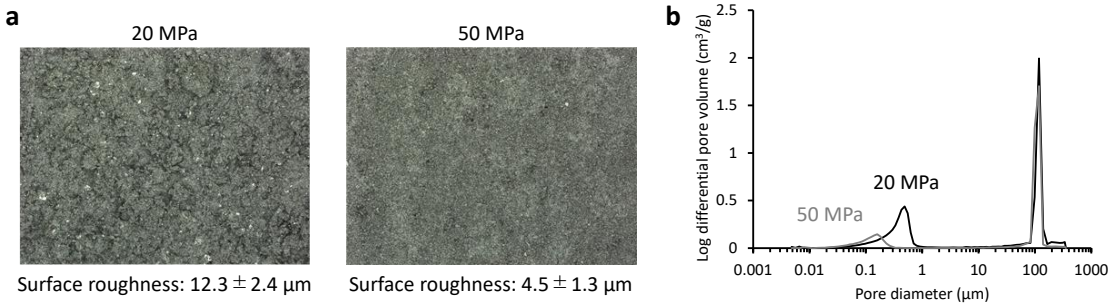

Figure S2. (a) Correlating surface roughness with the packing of spherical aggregates composed of CO_3Ap crystals and (b) the corresponding pore-size distributions. The spherical aggregates composed of CO_3Ap crystals were packed at 20 MPa and 50 MPa.

(a) Surface images of CO_3Ap compacts taken by laser scanning confocal microscopy, showing that the CO_3Ap compact fabricated at 20 MPa had a rougher surface than that prepared at 50 MPa. The surface roughness of the compacts fabricated at pressures of 20 MPa and 50 MPa were 12.3 ± 2.4 μm and 4.5 ± 1.3 μm, respectively. (B) Pore size distributions of CO_3Ap honeycomb scaffolds fabricated at pressures of 20 MPa and 50 MPa. These results demonstrate that spherical-aggregate packing affects both surface roughness and micropore size distribution.

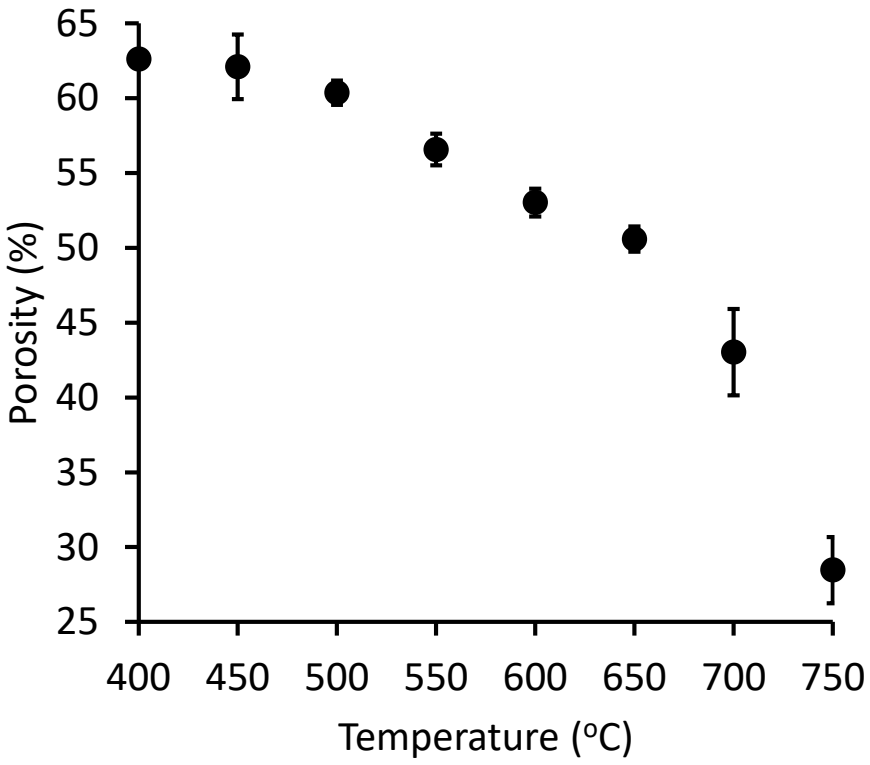

Figure S3. Correlation between the porosity of a $CaCO_3$ honeycomb and the heat-treatment temperature of the honeycomb GB.