Nanoscale Patterning of Biopolymers for Functional Biosurfaces and Controlled Drug Release

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SUPPLEMENTARY INFORMATION

PDMS Mold SEM

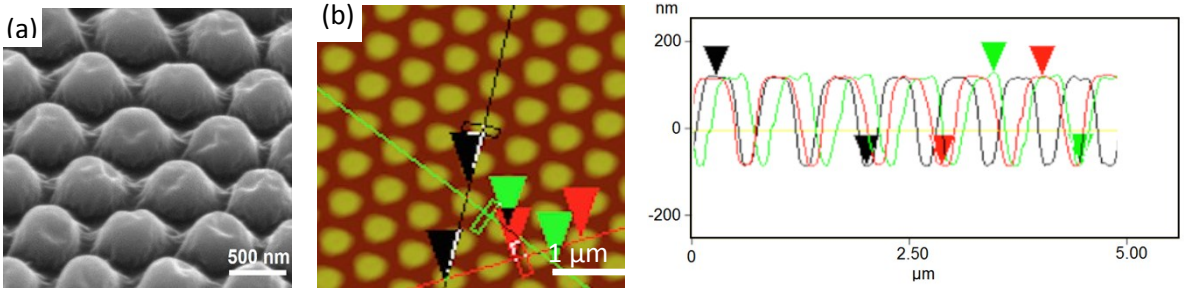

Figure S1. The surface of PDMS mold patterned with 750 nm pitch nanocone arrays. (a) SEM images of nanocones and (b) AFM images and the section profile. The nanocones exhibit average depths of 189 nm. Scale bar = 500 nm for (a) and 1 µm for (b).

PLLA Nanoimprinting Trials and Results

We also attempted nanoimprinting of PLLA by stamping the nanopatterned PDMS mold onto a PLLA film as shown in **Figure S2**. For this, the PLLA film was first prepared on the glass substrate by spin-coating (500 rpm, 60 seconds) and dried at room temperature for ~12 hours. Then the PDMS stamp was placed on the PLLA film with the pattern side facing the PLLA surface. Another glass substrate of the same dimensions covered the other side. The two glass substrates were pressed against each other using binder clips and the whole assembly was placed on a hot plate set at 100°C for 35 minutes. The glass transition temperature (T_g) of PLLA is ~60 °C. Therefore, the patterns in the PDMS can be fully embossed into the PLLA surface at a temperature (100°C) higher than T_g. Finally, the PLLA film was gently peeled off from the glass substrate by tweezers. The SEM images of nanoimprinted nanocup and nanocone PLLA films are shown in **Figure S3**.

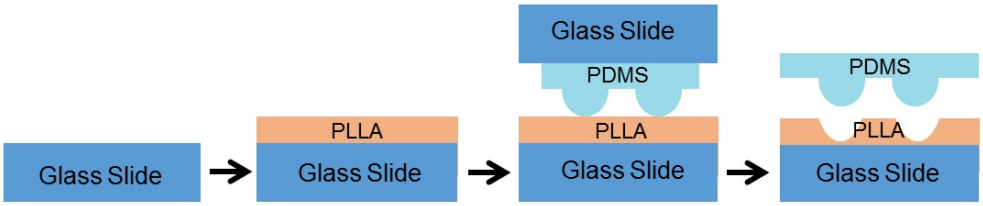

Figure S2. Process diagram for the imprinting-based nanotexturing of PLLA film. First, PLLA solution in chloroform is spin-coated on the glass slide. The PDMS stamp touching the PLLA is held between two glass slides and pressure is applied with the binder clips. The array of nanoholes is revealed on the PLLA after the pressure from binder clips is released.

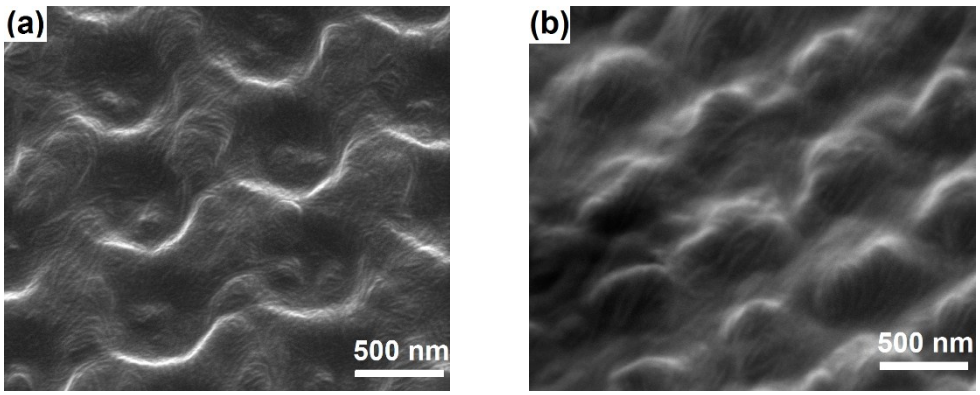

Figure S3. SEM images of nanoimprinted PLLA films (a) nanocups, (b) nanocones. (Scale bars: 500 nm for all)

PLLA Surface Brush Coated with Sirolimus

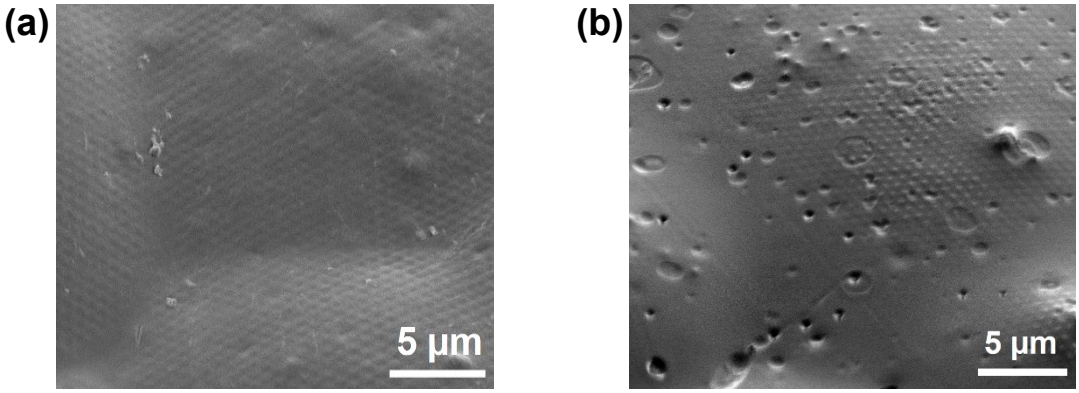

Figure S4. SEM image of the PLLA for (a) nanocup (b) nanocone array brush-coated with sirolimus. (Scale bar: 5 µm)

PLLA Tubular Structures

The nanopatterned PLLA films can easily be rolled into tubular forms. These PLLA tubes with patterns on the inner side can be used as scaffolding structures for cell culture and a framework for fabricating coronary stents. As shown in **Figure S5**, we wrapped the nanopatterned PLLA films around a cylindrical tube and joined the edge by dissolving it with chloroform using a fine brush. The diameter of the tube was ~2 mm and the length was ~1 cm.

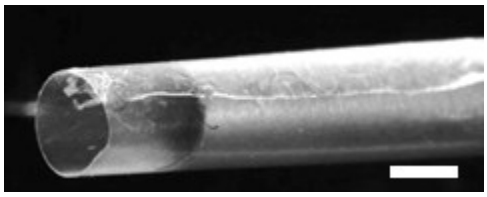

Figure S5. Optical microscope image of the PLLA tubular structure. (Scale bar: 2 mm)