Supporting Information for

Microscale Patterning of Thermoplastic Polymer Surfaces by Selective Solvent Swelling

Omid Rahmanian[1], Chien-Fu Chen[1,3], and Don L. DeVoe[1,2*]

[1]Department of Mechanical Engineering, [2]Department of Bioengineering, University of Maryland, College Park, MD 20742

[3]Graduate Institute of Biomedical Engineering, National Chung Hsing University, Taiwan

Orogenic growth for different grades of COC. The relationship between solvent exposure time and surface growth for different grades of COC was evaluated. Specifically, we selected Zeonor 1060R, Zeonor 1020R, and Topaz 8007X10 as candidate materials. A set of large (>500 µm wide) mask lines were patterned, followed by timed vapor-phase solvent exposure, and measurements of polymer growth were performed using a stylus profilometer. The resulting data is presented in **Error! Reference source not found.**Fig. S1. Each of the polymers exhibited increased growth with longer exposure times. For all of the tested polymers, the average surface roughness of the solvent-swelled regions remained below 50 nm for short (<10 min) solvent exposure times. With longer exposures, the roughness of both Zeonor 1020R and Topaz 8007X10 was observed to increase significantly, up to ~500 nm, while the roughness of Zeonor 1060R remained well below 50 nm over the full range of tested exposure times.

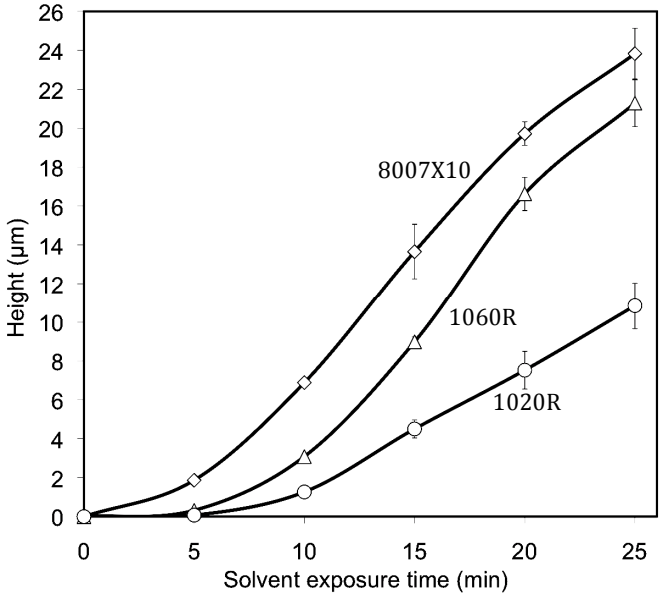

Figure S1. Comparison of growth heights for various COC grades (Zeonor 1060R, and Zeonor 1020R, and Topas 8007X10). Height changes were measured on multiple chips (n>3) far from the mask boundaries to avoid the influence of edge effects.

Impact of orogenic growth on COC surface roughness. Orogenic growth was found to have a favorable effect on surface roughness when using Zeonor 1060R COC. Surface roughness of the solvent-swelled regions was observed to decrease with extended exposure times, as revealed by the AFM data in Figure S2 comparing a clean native COC surface to a surface exposed to solvent vapor for 30 min. The root mean square surface roughness decreased from an initial value of 3.2 nm for native COC to a minimum value between 0.8–1.4 nm following 25 min solvent exposure, with no further reduction observed for longer solvent exposure times up to 60 min.

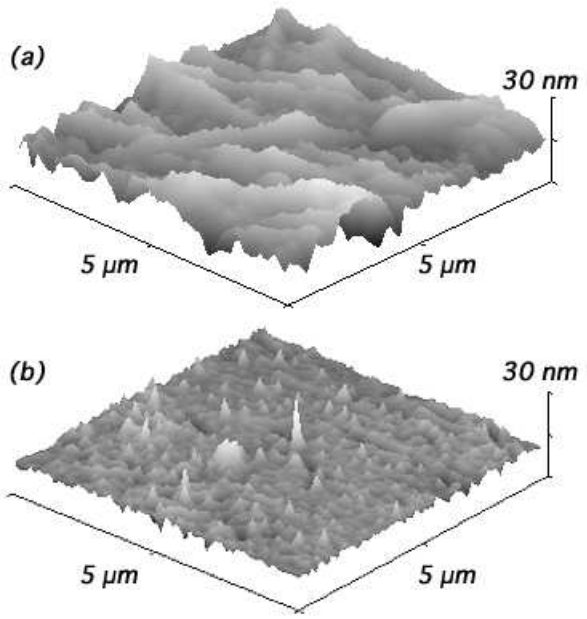

Figure S2. AFM profilometry data revealing a significant reduction in surface roughness during the transition from (a) a native COC surface prior to solvent exposure, to (b) a solvent-treated COC surface following 30 min exposure.