Contrast among B, O and H components in phase image

In order to determine the component based on an AFM phase image, a model experiment was conducted. B/O and B/H bilayer films were prepared by floating technique described as follows. O and H homopolymer films were prepared by spin-coating method onto silicon wafers. The film thicknesses were approximately 200 nm. B homopolymer films were separately prepared by spin-coating method onto silicon wafers. The B homopolymer films were floated off onto water surface and these films were picked up onto the O or H homopolymer film from the air side. The bilayer films were dried under vacuum for at least 24 h. AFM observations were conducted by using an SPA 300HV with NanoNavi controller (Seiko Instruments Industry Co., Ltd.) at 293 K in air. A cantilever tip used for the observation was microfabricated from silicon, and its spring constant and resonant frequency were 2 N·m⁻¹ and 324 kHz, respectively. This experimental condition is same as that for the BO films.

Figure S1 shows (a) topographic and (b) phase images of B/O bilayer film. The top and bottom layers were B and O, respectively. There is no contrast between B and O in the phase image shown in Figure S1(b). Figure S2 shows (a) topographic and (b) phase images of B/H bilayer film. The top and bottom layers were B and H, respectively. The z range in phases of Figure S1(b) and Figure S2(b) is 20 deg. In contrast to the B/O bilayer film, the H region in the phase image is much brighter than that in the B region. This implies that adhesion force of H is larger than that of B due to their polar group such as phenol.

Figure S1. (a) topographic and (b) phase images of B/O bilayer film.
Adhesion force for B, O and H homopolymers

The force-distance curve measurements for B, O and H homopolymers were separately conducted. A cantilever tip used for the force curve measurements was microfabricated from Si$_3$N$_4$, and its spring constant was 0.42 N·m$^{-1}$. Figure S3 shows typical force-distance curves for B, O and H homopolymers. The adhesion forces of B, O and H are 6.9±0.7 and 7.2±1.0, and 9.5±1.1 nN, respectively. This is consistent with the contrast in the phase images of B, O and H. Hence, these results revealed that the phase images became brighter as the adhesion force increased in this system.

Figure S3. Typical force-distance curves for (a) B, (b) O and (c) H homopolymer films.