

Supplementary Material (ESI) for Journal of Materials Chemistry
This journal is © The Royal Society of Chemistry 2009

Holographic photopolymers of organic/inorganic hybrid interpenetrating networks for reduced volume shrinkage

Seungwoo Lee,^a Yong-Cheol Jeong,^a Yongjoon Heo,^a Sun Il Kim,^b Yoon-Sun Choi,^c and Jung-Ki Park^{a}*

*To whom correspondence should be addressed. E-mail: jungpark@kaist.ac.kr. Tel: +82-42-869-3925.

Fax: +82-42-869-3910.

^aDepartment of Chemical and Biomolecular Engineering, Korea Advanced Institute of Science and Technology (KAIST), 373-1, Guseong-dong, Yuseong-gu, Daejeon 305-701, South Korea

^bFrontier Research Laboratory, Samsung Advanced Institute of Technology (SAIT), Mt. 14-1, Nongseo-dong, Giheung-gu, Yongin-si, Gyeonggi-do, 446-712, South Korea

^cDisplay Device & Processing Laboratory, Samsung Advanced Institute of Technology (SAIT), Mt. 14-1, Nongseo-dong, Giheung-gu, Yongin-si, Gyeonggi-do, 446-712, South Korea

Optical setup for transmittance holographic recording:

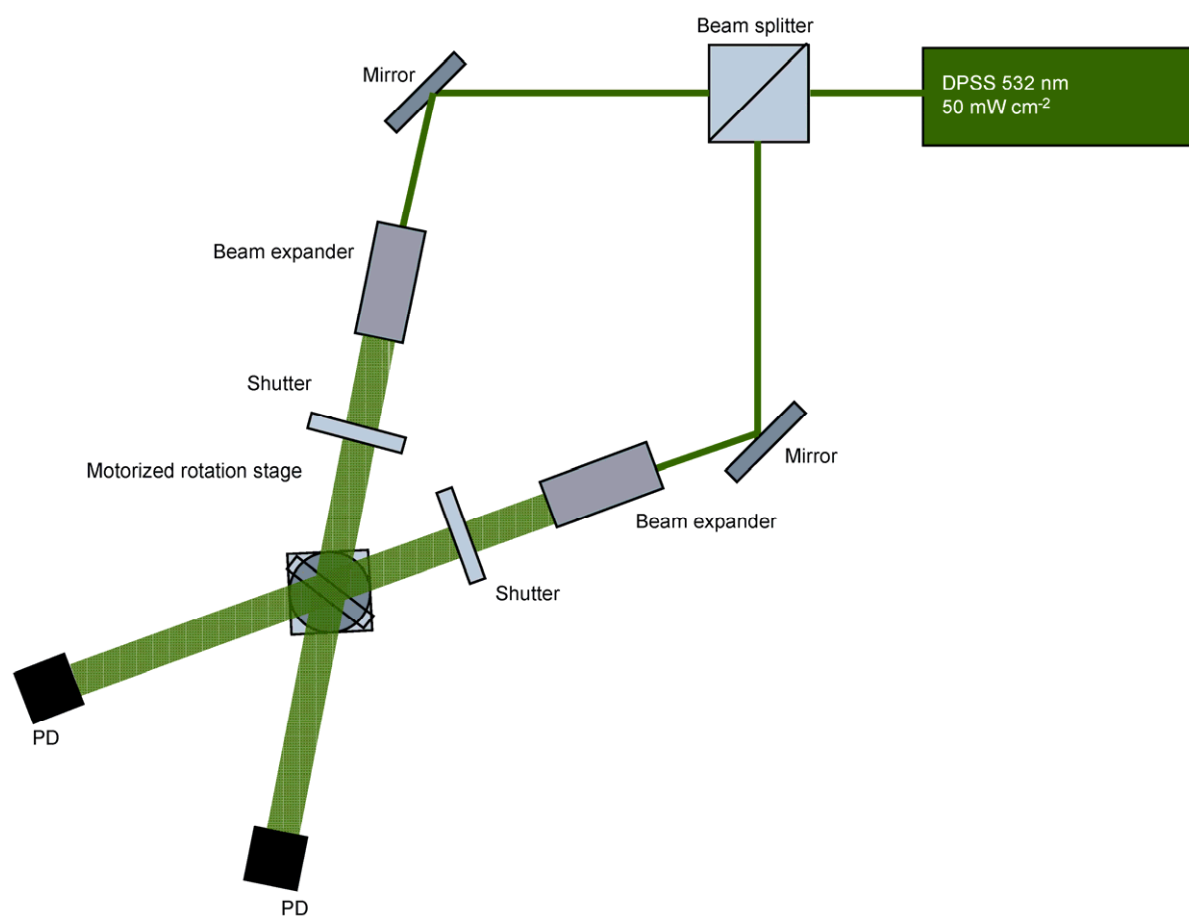


Figure S1. The schematic illustration of transmittance holographic optical setup.

Morphology of Pure epoxy resins and hybrid IPNs:

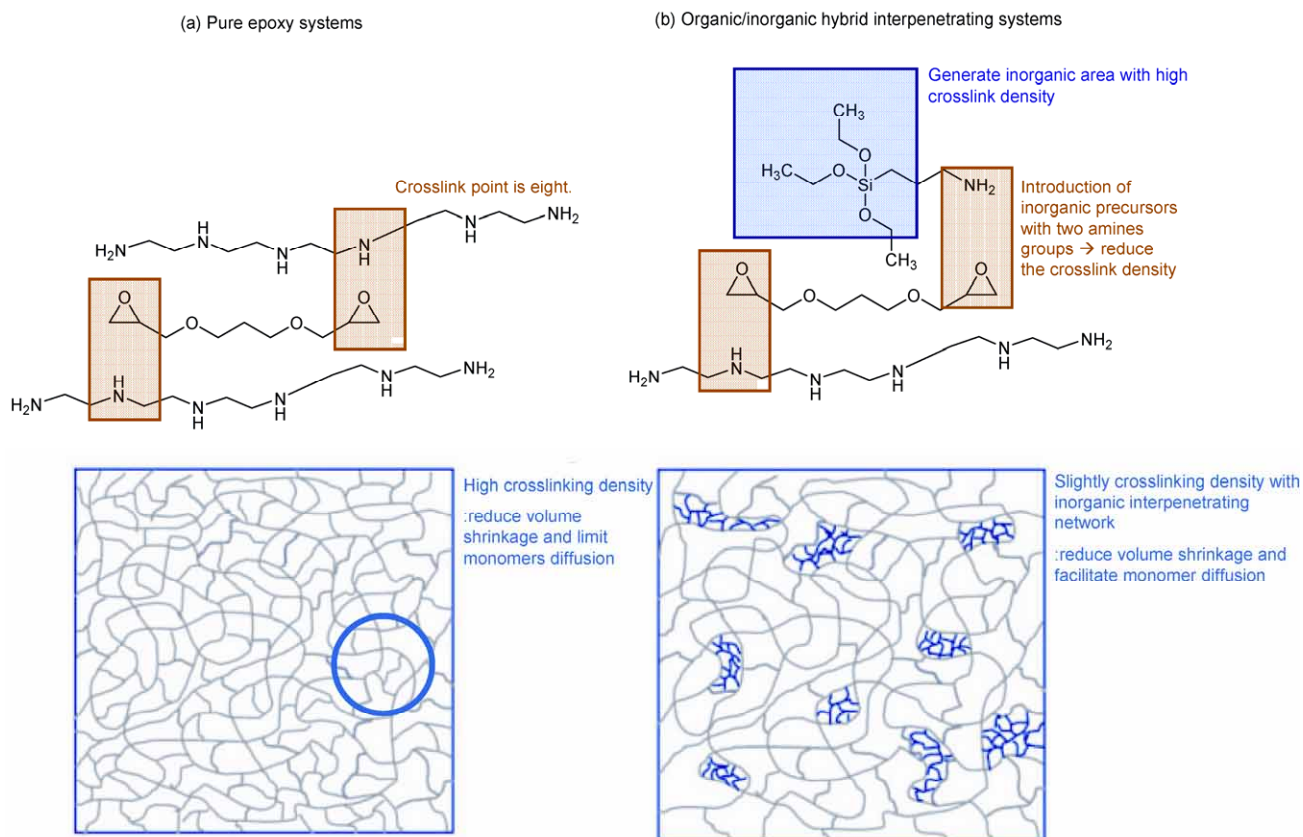


Figure S2. The schematic illustrations of model structures: pure epoxy resins and hybrid IPNs

In pure epoxy resins, extremely high crosslink density is induced, due to the high number of active amine protons per molecules. In contrast, introduction of APTES that possesses two active amine protons reduce the overall crosslink density of organic networks. Additionally, hydrolysis and condensation of alkoxy silane of APTES give rise to the formation of inorganic networks. In particular, the connectivity of inorganic networks is superior than that of organic networks, because Si atom is tetrafunctional.

Microscopic morphology of APTES 0, ATPES 1, and APTES 4

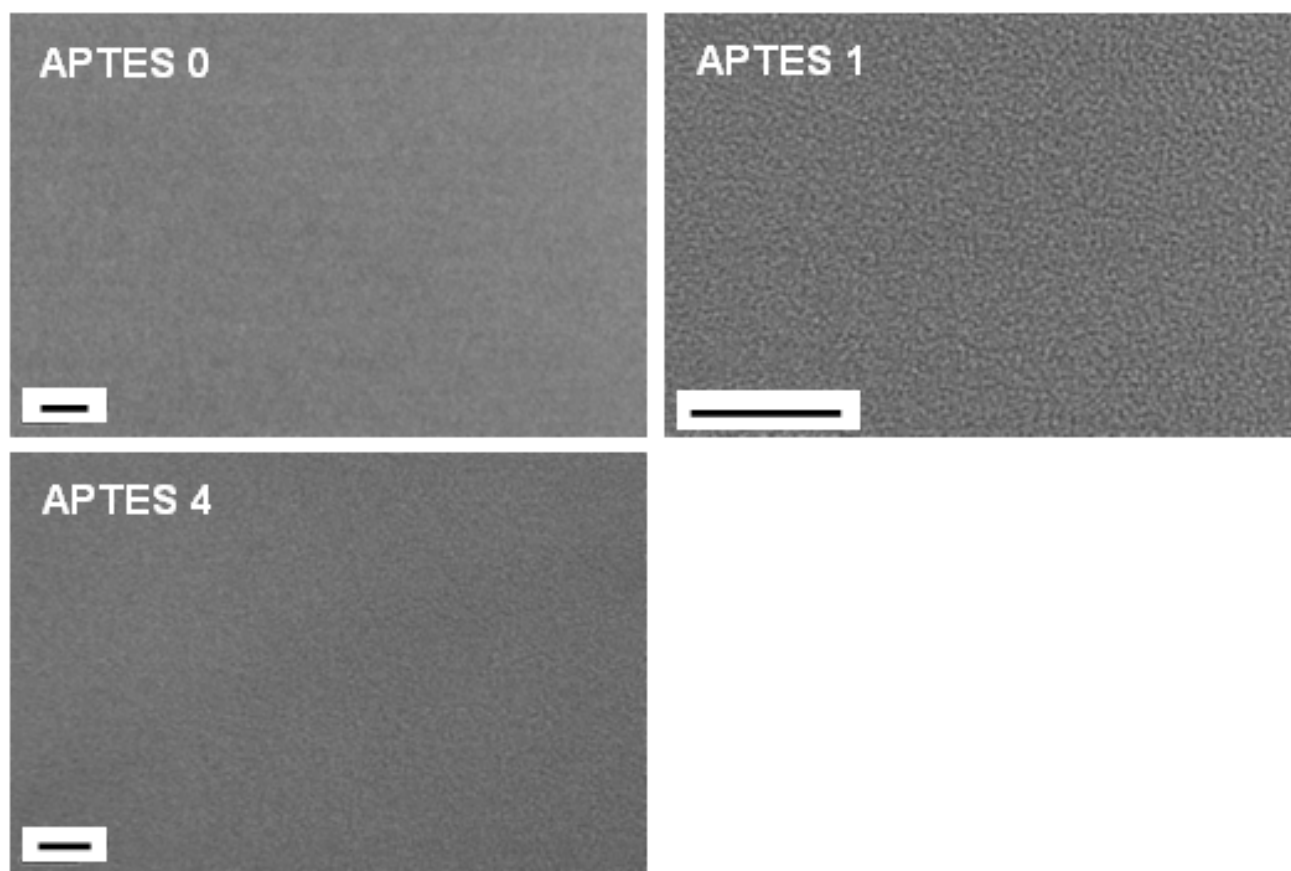


Figure S3. TEM images of APTES 0, APTES 1, and APTES 4. The scale bars represents 20 μm .

Because both APTES 1 and APTES 4 rarely formed the inorganic networks as shown in Figure 4 of the manuscript, no special features are observed. The scale bars are 20 nm.

Photopolymer film after holographic recording:

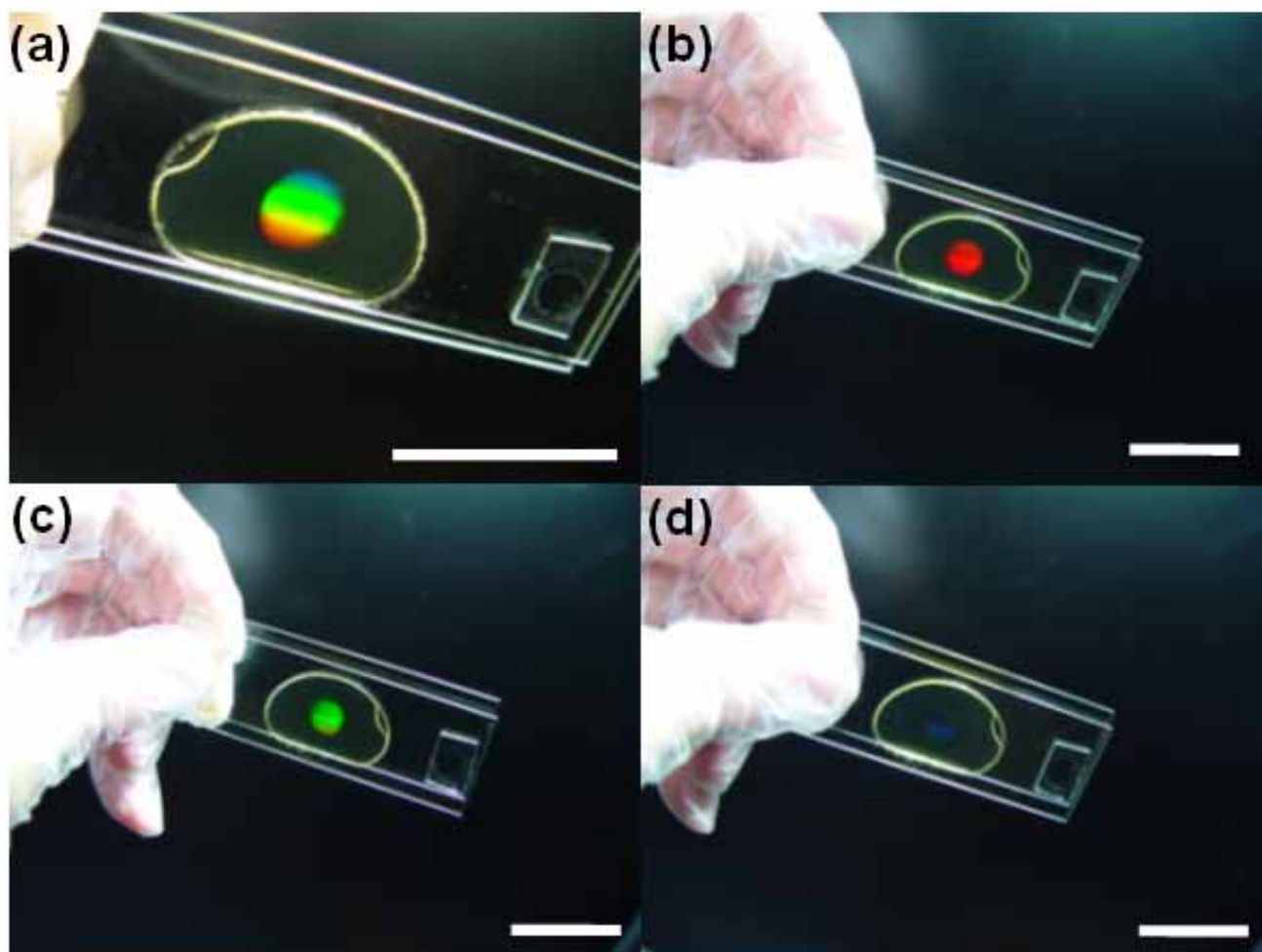


Figure S4. Iridescent colors of holograms taken at various angles.

Hologram recorded in APTES 3 clearly showed iridescent colors under white light illumination, as shown in Figure S4a. Additionally, we clearly see that light colors diffracted from holographic gratings were significantly dependent on the incident angle: red (b), green (c), and blue (d). This is due to the fact that red, green, and blue wavelength have different Bragg angle. The scale bars represent 2.5 cm.

Angular selectivity of grating transmittance:

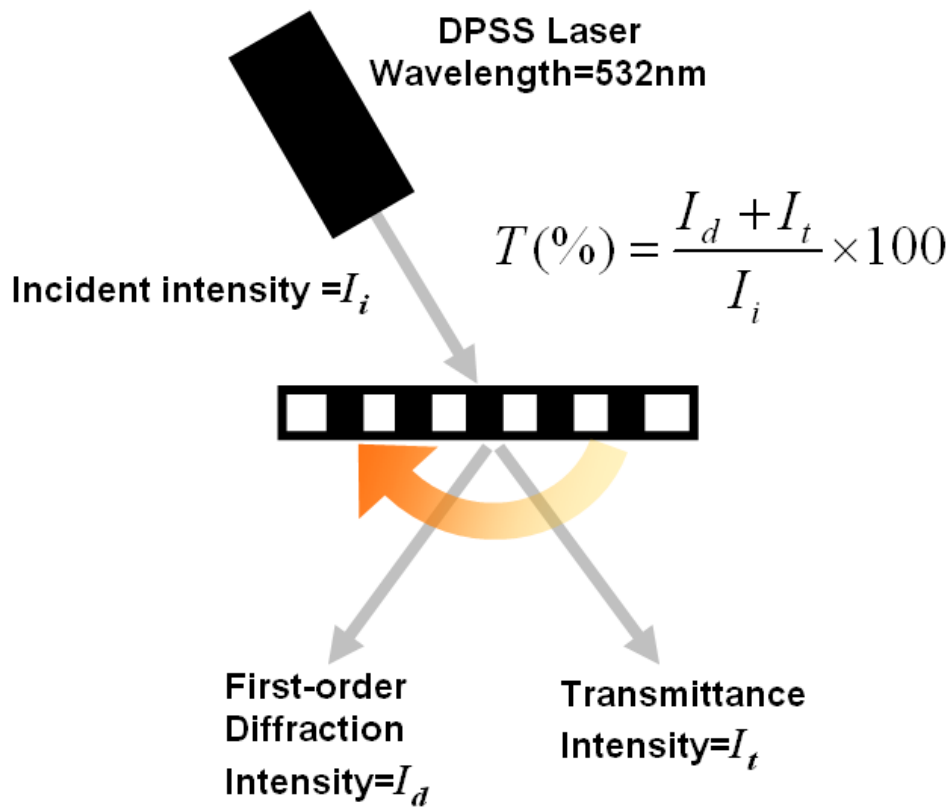


Figure S5. Definition of grating transmittance.

After recording single hologram, photopolymer films were fixed by single beam irradiation at normal incident angle while other beam was blocked by electronic shutter. Subsequently, fixed photopolymer films were rotated from -10° to $+10^\circ$ by constant angle of 0.5° ; 0° was Bragg angle of recorded holograms. At each incident angle, we measured both first-order diffraction intensity and transmittance intensity, and grating transmittance was estimated by the definition described in Figure S5.

Holographic imaging under asymmetric geometry:

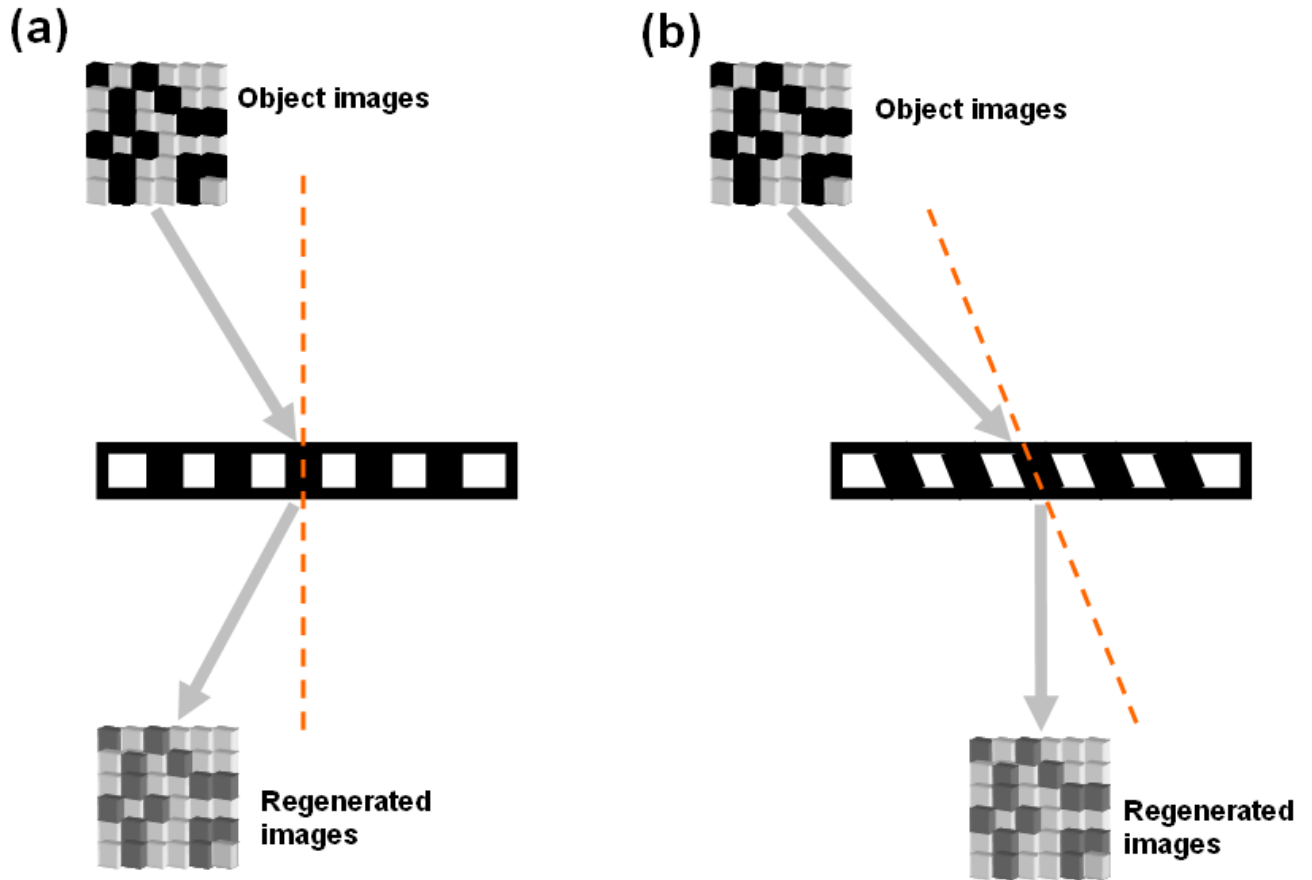


Figure S6. Holographic imaging under symmetric geometry (a) and asymmetric geometry (b).

Figure S6 explains that the angle of regenerated hologram images was determined by slant angle. When slant angle was 0° , recorded holograms were regenerated at incident angle (Figure S6a). As shown in Figure S6b, holograms recorded under asymmetric geometry can be regenerated at normal angle.