Supporting Information

Blue Laser Diodes Initiated Photosensitive Resins for 3D Printing

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Experimental Section

Materials: Bisphenol-A type epoxy acrylate (Bisphenol A-type EA, RJ313, Ryoji, Japan), aliphatic polyurethane acrylate (PUA, FSP57241, Wraio, China) and urethane acrylate (UA, Unicryl R-71621, Wraio, China) were purchased from local chemical agency. TMPTMA, TMPTA, HDDA, DEGDA, TEGDA, TMSPA, CQ, and EDMAB were purchased from J&K Scientific Ltd. Glass fibers were offered by Chongqing Polycomp International Corporation, China.

Photosensitive resins preparation: The resins were formulated by stirring the mixture of all components in a light-sealed flask at ambient temperature until a homogenous solution was formed. Fillers can be added into the mixture according to the requirement.

Characterization: The optical output power was determined by a photo power meter equipping with a 919P thermopile sensor (Newport Corporation in California). The UV-vis absorption spectra was performed on a PerkinElmer Lambda 950 instrument. The mechanical properties were measured on an Instron 3346 machine at room temperature (~28 ºC). The gauge length and the crosshead speed were 20 mm and 50 mm/min, respectively. Scanning electron microscopy (SEM) images were captured by using a JSM-7500F (JEOL, Japan) field-emission scanning electron microscope at an accelerating voltage of 5 kV. The double bond conversion was determined on a Thermal Fisher Nicolet 5700 instrument. The conversion was calculated according to the peak area ratio between carbonyl group (~1730 cm^{-1}) and vinyl group (~1629 cm^{-1}). Samples were cured by a blue laser projector at five laser exposure levels, which were controlled by varying the exposure time with fixed power intensity via the software. After polymerization, the thickness of the cured gel was measured with a vernier caliper.

3D printing process: The 3D model was built with the computer-aided design and saved as a STL file. Using the slicing software creation workshop, the digital model was sliced to a group of two-dimensional mask images. These images were sent to the laser projection device and projected on the bottom of the resin tank. According to the projected image, the bottom resin layer was selectively cured and attached to the

previous layers. The translation stage pulled up the cured layers for a pre-set layer thickness, and a liquid resin layer was formed underneath. Repeating this process, the 3D objet can be formed gradually. In the printing process, the layer thickness was set to 50 μm and each layer was exposure to light for 3-10 seconds with the light power density of 10 mW/cm^2.

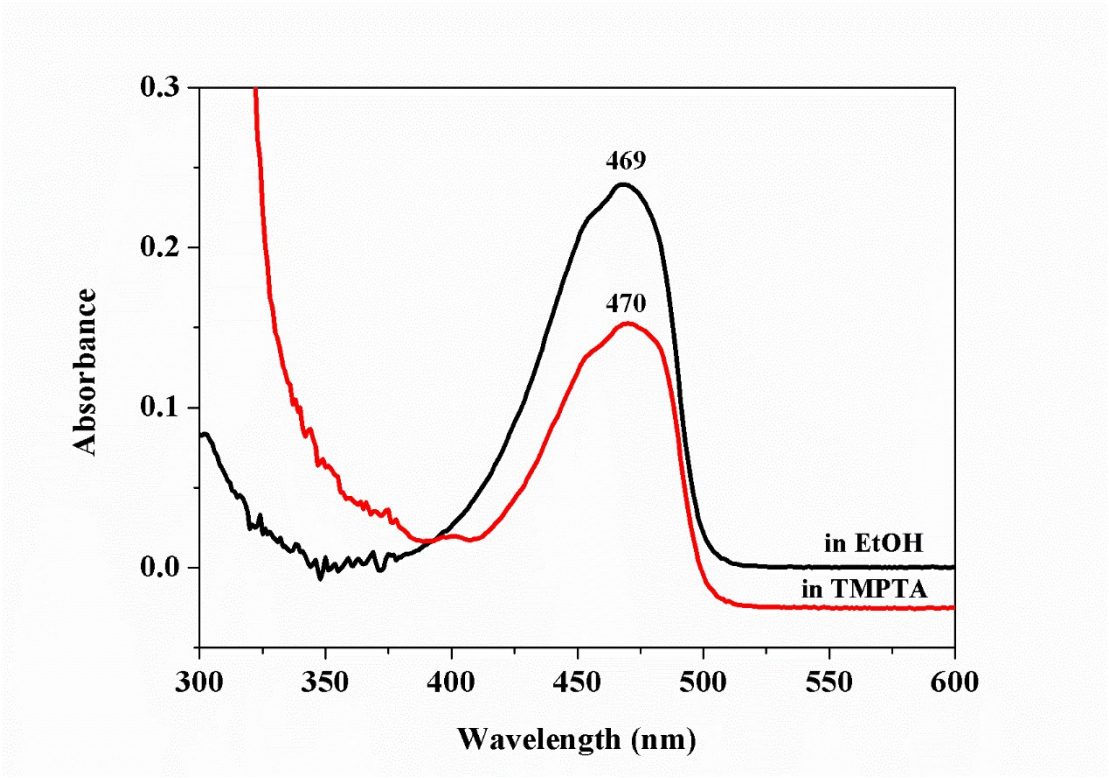

Figure S1. UV-vis absorption spectra of CQ in EtOH and TMPTA.

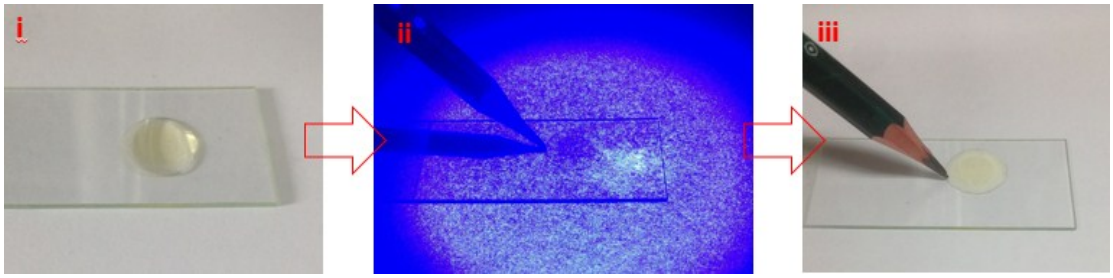

Figure S2. Schematic diagram of the measurement of solidification time.

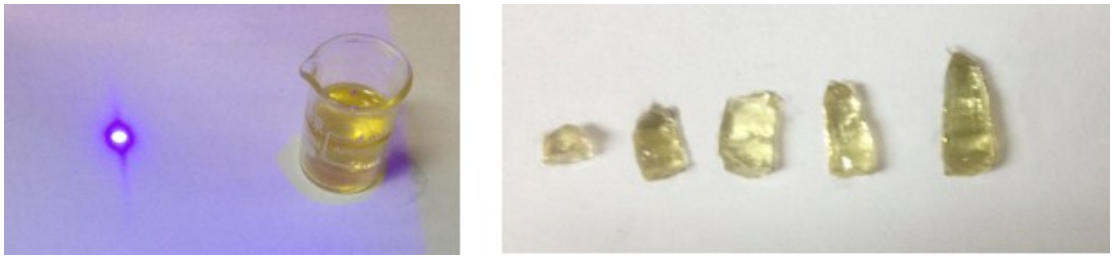

Figure S3. Photos of curing depth measurement. The laser power intensity was 3.6 mW/cm^2 and the exposure time was increased from 10 to 20 s in a step of 2.5 s.

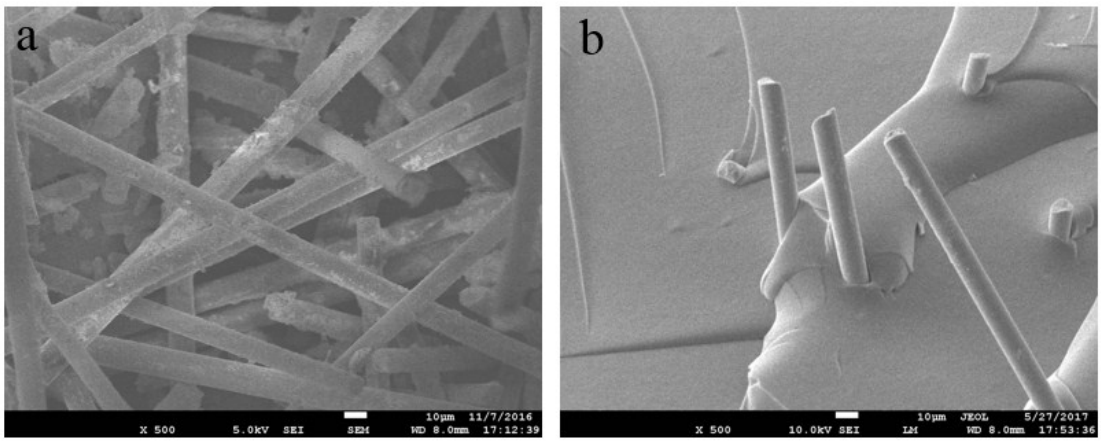

Figure S4. SEM images of (a) glass fibers and (b) the fracture surface of the printed composites.

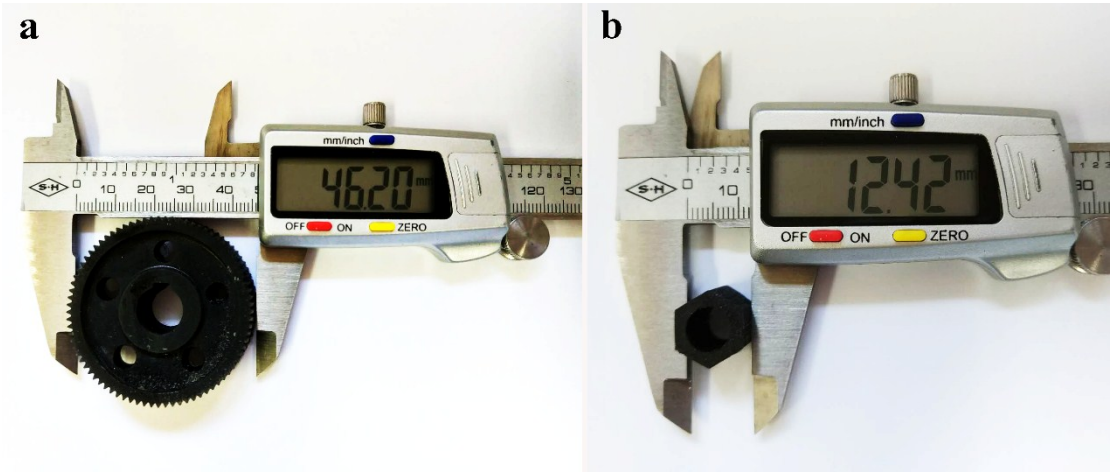

Figure S5. The dimensions of printed objects with regular shapes. The diameters of models and printed objects are (a) 46.0 and 46.20 mm,(b) 12.0 mm and 12.42 mm. The difference values are about 200 and 420μm, respectively.

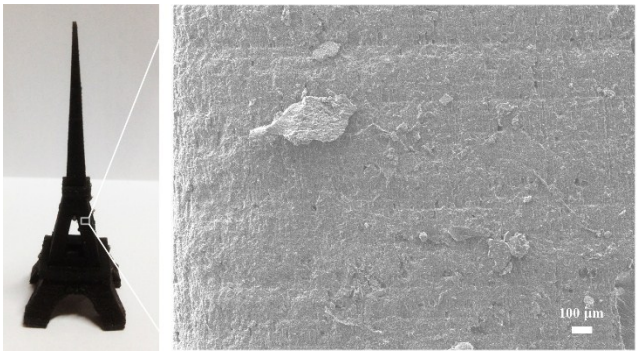

Figure S6. The surface morphology of the printed object investigated by SEM.

Table S1. The cure depth vs laser energy value.

Energy (mJ/cm^2)	36	45	54	63	72
Cure depth (mm)	2.4	3.5	4.4	5.1	5.6

Resin formulations for the objects presented in Figure 5:

b and c: EA (40 g), HDDA (80 g), CQ (1.2 g), EDMAB (1.2 g), graphene (1.2 g, Baotailong New Materials Ltd, China).

d: aliphatic PUA (40 g), UA (80 g), CQ (1.2 g), EDMAB (1.2 g), graphene (1.2 g, Baotailong New Materials Ltd, China).

e: EA (40 g), HDDA (80 g), CQ (1.2 g), EDMAB (1.2 g), Pigment red 53 (1.2 g, J&K Scientific Ltd).