

Polymer/Nanoparticle Hybrid Coatings with the Graded Nanostructures via Controlled UV Curing

William Alexander Budiman¹, Kenichi Oyaizu¹, Takeo Suga^{1,*}

¹Department of Applied Chemistry, Waseda University, Tokyo, Japan

*Email: william.budiman@akane.waseda.jp / takeosuga@waseda.jp

The utilization of polymer dormant with carbon-iodine (C-I) terminals in photo-controlled radical polymerization has enabled the formation of bi-continuous microphase-separated nanodomains. A polymeric dormant can be reactivated via iodine-mediated radical polymerization, that allows the controlled chain extension to give block copolymers. A glycidyl-containing polymeric dormant (**PGMA-BA-I**) was used in the preparation of an organic-inorganic hybrid UV-cured film with zirconia nanoparticles.

The polymeric dormant, **PGMA-BA-I**, was dissolved in an acrylate monomer along with zirconia nanoparticle dispersion. A triacrylate crosslinker and photocatalysts triphenylphosphine (PPh₃) and/or 10-phenylphenothiazine (PTH) were added and then bar coated on PET film before UV irradiation. Cross-sectional transmission electron microscope (TEM) images of the coatings revealed the selective incorporation of the zirconia nanoparticles in the epoxy (GMA) domain. In addition, a gradient-arranged zirconia nanoparticles coating morphology was obtained by utilizing triphenylphosphine (PPh₃) as the catalyst at low equivalent amounts. Furthermore, the domain size and the gradient direction can be tuned by using 10-phenylphenothiazine (PTH) photo-redox catalyst. The optical properties, especially the reflectance, that the different nanostructures exhibit was also evaluated.

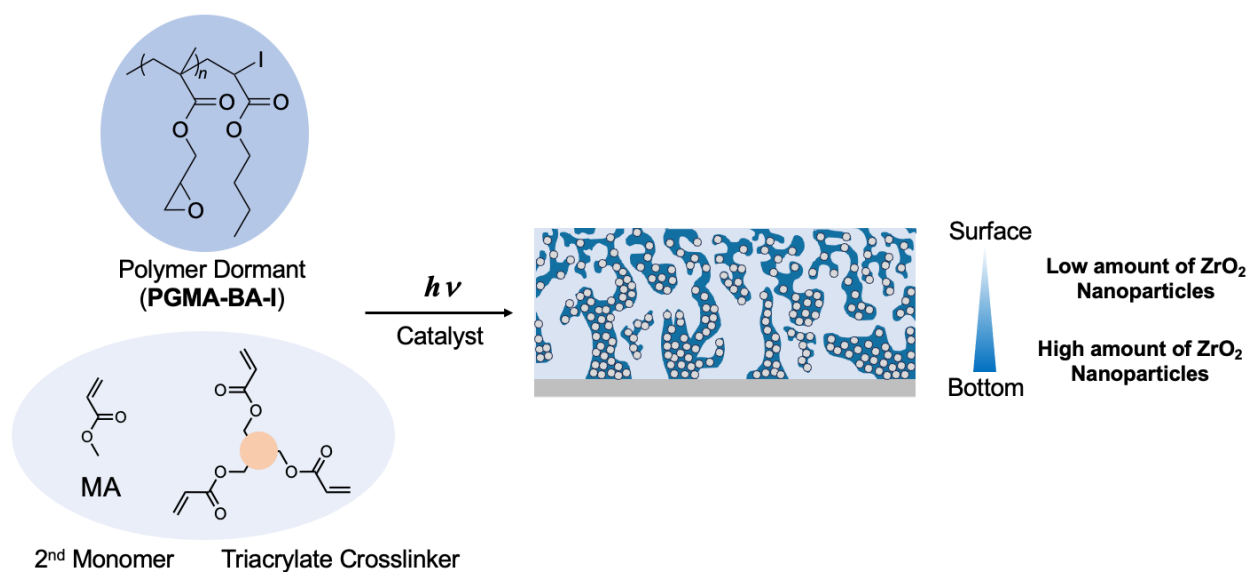


Fig. 1 Preparation scheme and illustration of the photocured hybrid coating with gradient structure.