THE SCOPE OF BAYFOL HX® FILMS FOR HOLOGRAPHIC RECORDINGS AND ITS PHOTOCHEMISTRY AT A GLANCE

Friedrich-Karl Bruder[a], Johannes Frank[a], Mira Holzheimer [a], Alexander Lorenz[a], Christel Manecke[a], Jack Mills[b], Lena Nault[a], Igor Pochorovski[a], Thomas Rölle[a,*]

[a]Covestro Deutschland AG, Chempark Leverkusen, D-51365 Leverkusen, Germany

[b]Covestro LLC, 1 Covestro Circle, Pittsburgh, PA 15205, USA;

Bayfol® HX photopolymer films are available as easy-to-process recording materials for volume holographic optical elements (vHOEs).[1] Their recording capabilities from 450 – 850 nm and replay even in a lager spectral range are two of their major advantages. Moreover, the adjustable diffraction efficiency, tunable angular and spectral selectivity of vHOEs recorded into Bayfol® HX as well as their unmatched post-bleaching optical clarity enables superior invisible “off Bragg” optical functionality. As a film product, the replication of vHOEs in Bayfol® HX can be carried out in a highly cost-efficient and purely photonic roll-to-roll (R2R) process. Other supply forms can be considered as well.

Based on a proprietary chemical toolbox, Bayfol® HX can be adopted for a variety of optical applications. We will describe this class of holographic photopolymers and the many photochemistry aspects to build a light-sensitive material in detail, and the chemical response that is based on a reaction-driven diffusion process. Herein, two-component photo initiating systems are especially efficient to photo-polymerize in the visible spectrum. They typically consist of a sensitizer dye that absorbs light and a co-initiator that interacts with the dye to form the initiating species. The initiation mechanism of the radical chain formation involves a photo-induced electron transfer forming the initiating radicals. The chemical energy of the monomers is ideally fully transferred into the targeted refractive index modulations that ultimately form the holographic pattern.

After recording the vHOE, it is necessary to finally bleach and cure any residuals to obtain a highly transparent material (off-Bragg). A combination of light sources can be used to bleach and cure the photopolymer, insights into the photochemical pathways of the former dye molecules will be explained.

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[1] Bruder, F.-K., Fäcke and T., Rölle, T., "*The Chemistry and Physics of Bayfol® HX Film Holographic Photopolymer*," Polymers **9** (10), 472 (2017).

* thomas.roelle@covestro.com