

Photopolymer

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A photopolymer or light-activated resin is a polymer that changes its properties when exposed to light, often in the ultraviolet or visible region of the electromagnetic spectrum. [1] These changes are often manifested structurally, for example hardening of the material occurs as a result of cross-linking when exposed to light. An example is shown below depicting a mixture of monomers, oligomers, and photoinitiators that conform into a hardened polymeric material through a process called curing. [2] [3] A wide variety of technologically useful applications rely on photopolymers, for example some enamels and varnishes depend on photopolymer formulation for proper hardening upon exposure to light. In some instances, an enamel can cure in a fraction of a second when exposed to light, as opposed to thermally cured enamels which can require half an hour or longer. [4] Curable materials are widely used for medical, printing, and photoresist technologies.

Changes in structural and chemical properties can be induced internally by chromophores that the polymer subunit already possesses, or externally by addition of photosensitive molecules. Typically a photopolymer consists of a mixture of multifunctional monomers and oligomers in order to achieve the desired physical properties, and therefore a wide variety of monomers and oligomers have been developed that can polymerize in the presence of light either through internal or external initiation (Figure 1). Photopolymers undergo a process called curing, where oligomers are cross-linked upon exposure to light, forming what is known as a network polymer. The result of photo curing is the formation of a thermoset network of polymers. One of the advantages of photo-curing is that it can be done selectively using high energy light sources, for example lasers, however, most systems are not readily activated by light, and in this case a photoinitiator is required. Photoinitiators are compounds that upon radiation of light decompose into reactive species that activate polymerization of specific functional groups on the oligomers. [5] An example of a mixture that undergoes cross-linking when exposed to light is shown below. The mixture consists of monomeric styrene and oligomeric acrylates. [6]

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References

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Figure 1. Photopolymer

