Monolithic Thiol-ene Materials with Drastically Different Mechanical Properties

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Abstract：Thiol–ene materials can be obtained through traditional thermal conditions with common azo-species such as 2,2-azobis(isobutyro-nitrile) (AIBN) or via with little or no added photoinitiators' photochemical thiol–ene reaction methods[1]. During the last century, thiol-ene material is a global focus because of the highly efficient reactions of thiols with reactive C=C bonds , has widely application in hydrogel drug delivery, coatings, adhesives, optical applications , dendrimer synthesis, all-solid-state electrolyte ,high strength laminates, dental resins and electroluminescent films[2]. In particular, two thiol reactions emerged, thiol–ene free-radical addition to electron-rich/electron-poor C=C bonds, and the catalyzed thiol Michael addition to electron-deficient C=C bonds. Unlike typical chain-growth free-radical polymerizations or step-growth condensation polymerizations, thiol-ene polymers form in a stepwise manner but their formation is facilitated by a rapid, highly efficient free-radical chain-transfer reaction. Thus, crosslinked thiol-ene polymerizations proceed very rapidly but will not reach the gel-point until relatively high functional group conversions.

To get the sandwich structure column shape sample, we made the hard segment and soft segment polymer, respectively. The polymer has the highest degree of hardness at a 3:4 thiol/vinyl stoichiometric ratio primarily attributable to the high cross-linking density[3,4]. The hard polymer liquid was prepared by using the ratio(1:1) of Pentaerythritol tetrakis (3-mercaptopropionate) **PETMP** to Triallyl-1,3,5triaz-ine-2,4,6-trione **TATATO**. The soft liquid was obtained in the same way except for replacing the **TATATO** with Trimethylolpropane diallyl ether **PMDPE**. (***Figure.1***).

The thermal properties of hard and soft polymer were characterized using the differential scanning calorimeter (DSC). The mechanical properties of polymer is intimately related to their molecular structure, one of the most important mechanical property is rheological behavior, which can be measured by shear rheometry and filament stretching rheometer (FSR).

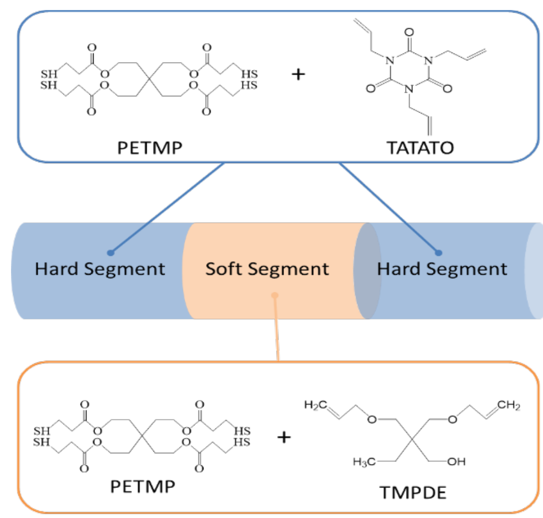

Figure 1. *The difference components of hard segment and soft segment*

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