Preparation and characterization of self-healable poly(methyl methacrylate) copolymers through the thermally reversible Diels-Alder reaction by controlling electron density of furan moieties of copolymers

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In this work, we adjusted electron density of furan moieties of furan-functionalized copolymers to investigate difference of self-healing properties according to reactivity of Diels-Alder reaction. A series of copolymers were synthesized by free radical polymerization using furan-functionalized methacrylates(furoyl ethyl ether methacrylate(FEEMA) as an electron deficient group and furfuryl 2-(methacryloyl)ethyl carbamate(FMAEC.M) as an electron rich group) and poly(ethylene glycol) methyl ether methacrylate(PEGMA) as monomers and 2,2'-azobis(2-methylpropionitrile)(AIBN) as an initiator. Also 1,1'-(methylenedi-4,1-phenylene)bismaleimide(bM) was used as a cross-linker for thermally reversible Diels-Alder reaction.

We found that the tensile strength increases and elongation decreases as furan conversion increases. On the basis of these result, copolymers containing 50% of furan moieties with equivalent amount of bM were selected for the characterization of self-healing performance.