Development and Application of Oxidatively Degradable Polymers

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Abstract

Diacylhydrazine is thermally stable functional group, and is inert to oxygen, although it rapidly oxidized to decompose by the suitable oxidant such as sodium hypochlorite solution. Therefore, poly(diacylhydrazine) can be used as an oxidatively degradable polymer: An artificial stimulus-responsive degradable polymer. The degradation product is carboxylic acid, from which poly(diacylhydrazine) can be recycled.

Bisphenols modified with diacylhydrazine moieties were prepared as the curing agent for epoxy resin. The cured resin exhibited high thermal stability, and could be used as a strong adhesive for metal and glass. The adhered substrates were spontaneously separated by the treatment with sodium hypochlorite solution without any trace. Reversible crosslinking could be accomplished by the diacylhydrazine linkage. Copolymer of PMA was hydrazinated, and the resulting polymer was crosslinked by the oxidative coupling reaction of hydrazide or by the acylation with diacid chlorides. The crosslinked polymers were decrosslinked by the oxidative degradation of diacylhydrazine linkage with sodium hypochlorite solution. The carboxy group formed by decrosslinking was converted to the methyl ester group by the treatment with trimethylsilyldiazomethane to obtain the original copolymers. The cycle of hydrazination-crosslinking-decrosslinking-esterification could be repeated. Transparent crosslinked polymer plate can be prepared by the bulk polymerization of *N*,*N*-dialkylacrylamide and *N*,*N*'-diacryloylhydrazine.

Keywords**:** *Diacylhydrazine, Oxidatively degradable polymer, Adhesive, Epoxy resin, Reversible crosslinking, Recycling*

Proceedings of RSU Research Conference (2019)