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Novel Hydrosilane-containing Coupling Agents – Synthesis and Application for Interface Modification in Polymer Blends

J. Pionteck (a), V.B. Sadhu (b), L. Jakisch (a), P. Pötschke (a), L. Häußler (a), and A. Janke (a)
(a) Leibniz Institute of Polymer Research Dresden, Hohe Str. 6, D-01069 Dresden, Germany
(b) former collaborator

Novel coupling agents containing 2-oxazoline and/or 2-oxazinone as well as hydrosilane moieties have been prepared by hydrosilylation of the corresponding allyl ether containing precursors with poly(methylhydro)siloxanes. These hydrosiloxane containing coupling agents, termed as SCA, contain 1 to 2 reactive sites for the reaction with amino- or carboxy-containing polymers and 5 to 20 Si-H units, which can be used for further modification, e.g. crosslinking. The crosslinkability of the SCA was proven by DSC and solubility experiments.

The SCA were used for the modification of interfaces in heterogeneous polymer blends. In model blend systems based on carboxylic acid-terminated polystyrene (PS-COOH) and amino terminated poly(methyl methacrylate) (PMMA-NH_2) or PS-COOH and amino-terminated polyamide-12 (PA-NH_2) the 2-oxazoline and 2-oxazinone units of the SCA can selectively react with the carboxylic groups or amino groups, respectively. The SCA are immiscible with the studied polymers and form always an own phase. The hydrosilane units of the SCA partially crosslink under the used mixing conditions. The addition of platinum catalyst to the ternary blend system accelerates the crosslinking of the SCA.

The morphology of the blends strongly depends on the composition and processing conditions. At a particular volume composition the ternary PS-COOH/PMMA-NH_2/SCA blend exhibits a co-continuous morphology whereas the binary blend (devoid of SCA) exhibits a mixed morphology containing continuous and particle structures. The co-continuity is pronounced in presence of Pt catalyst during mixing. AFM studies suggest that the SCA locate at least partially at the interface between the immiscible polymers, as well in PS-COOH/PMMA-NH_2 blends as in PS-COOH/PA-NH_2 blends.