Tough and adherable styrene–butadiene rubber with zinc-nitrogen coordination linkages via tetrazine click reactions

Kyohei Kotani
Sustainable and Advanced Materials Division, Bridgestone Corporation,
3-1-1, Ogawahigashi-cho, Kodaira-shi, Tokyo 187-8531, Japan.

Abstract

Rubber to rubber adhesion is one of the most important processes for tire manufacturing[1]. However, it is commonly known that the direct adhesion of cross-linked rubber without pretreatment of rubber surface is quite difficult due to restricted mobility of polymer chain by crosslinking. Therefore, repairing process of cured tire including retread application is limited. The introduction of reversible linkages as cross-linking bonds into cured rubber is expected to be one of the candidates to solve this problem as reversible linkages show different temperature dependency in comparison with conventional covalent bonds[2].

In this research, we focused on introduction of metal-ligand coordination linkages as a cross-link network system into styrene butadiene rubber (SBR) and applied it to direct adhesion of cured rubbers. Nitrogen functional groups are incorporated into SBR by using a tetrazine click reaction at a kneading process. Then, the introduced nitrogen groups on SBR could work as coordination sites and form metal-ligand cross-link system with Zn^{2+} after mixing with zinc dimethacrylate (ZDMA) (**Figure 1**.). Due to the reversibility of dissociation and bonding with metal-ligand coordination linkages, the coordination cross-linked SBR composite exhibited excellent tensile strength. Furthermore, a direct adhesion behavior of the corresponding rubber composite after remolding was demonstrated by T-peel tests[3].

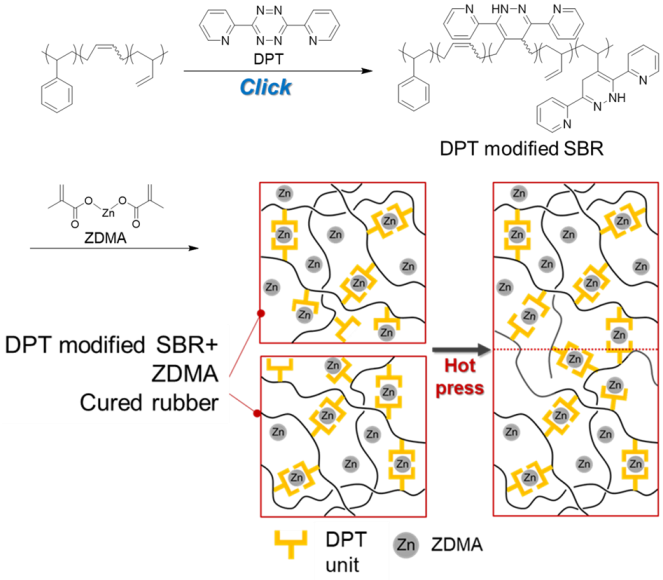

Figure 1. Preparation of DPT-Zn cross-linked SBR and its schematic image of adhesion process.

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References

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