有機ホウ素化合物と酸素を開始剤としたスチレンの重合　　1205016 成岡　佑輔

Polymerization of styrene using organoboron and oxygen as an initiator

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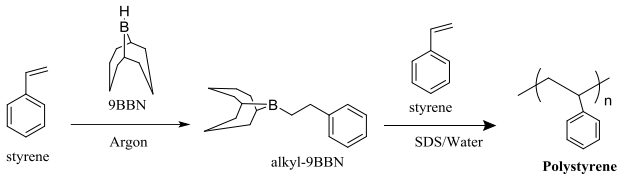
<Abstract>

Organoboron compounds generate free radicals by reacting with oxygen and has high reactivity as organic synthesis reagents. However, they are pyrophoric organometallic compound and are very unstable in air and water. Widely used organoboron is tributylborane(TBB), which has been used as a polymerization initiator. In the polymerization of styrene using TBB, it is reported that the bulk polymerization rate is fast but low molecular weight, and solution polymerization rate is considerably slowed but high molecular weight polymer was obtained. In order to industrially produce polystyrene using organoboron and oxygen as an initiator, it is required to obtain a high molecular weight polymer by increasing the polymerization rate. In this study, polymerization method was investigated using various organoboron compounds for the purpose of obtaining high molecular weight polymer with good yield.

<Experience>

TBB and alkyl-9-BBN were used as initiators. Alkyl-9-BBN was prepared by mixing 9-BBN and styrene (molar ratio = 1:1) at 23 °C for 1 h just before use. Styrene emulsion polymerization was carried out for 48 h under an argon atmosphere in an aqueous sodium dodecyl sulfate (SDS) solution. The molecular weights of polystyrene relative to a polystyrene standard were determined using SEC.



<Result conclusion>

In the emulsion polymerization using TBB, the yield was increased in proportion to the time at 23°C, and high molecular weight polystyrene having a yield of 38% and a molecular weight of 2,000,000 was obtained by polymerization for 24 hours. On the other hand, ultra-high-molecular-weight (>10,000,000) polystyrene was synthesized using alkyl-9-BBN in a high yield (>80%). It was found that the molecular weight and yield were affected by the ratio of monomer to initiator and the amount of the emulsifier in both polymerization methods. Furthermore, it was suggested that the structure of the organoboron compound influences yield and molecular weight.

<Reference>

Zhao C.; Sugimoto R.; Naruoka Y. Chinese Journal of Polymer Science　2018　36(5), 1-6