MERIT Internship Report

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【Period】
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【Host institution】
RIKEN Emergent Bioinspired Soft Matter Research Team

【Abstract】
RIKEN Emergent Bioinspired Soft Matter Research Team has studied and reported a number of the soft material including functional hydrogels, organic thin films and liquid crystals. Especially, they have expertise in evaluation of physical and thermal property of organic polymer materials. In a MERIT internship program at RIKEN, series of polymer blends were prepared and their physical properties were characterized.

【Research activities】
Self-healable or healable materials have attracted increasing attention due to their enhanced longevity, reliability and safety. Numerous materials have been reported so far, healable materials without heating under ambient conditions are always in the soft material regimes. On the other hand, healing of hard materials essentially requires heating. Aida group recently found a polymer glass with Young's modulus of 1.4

GPa can be repaired by manual compression without heating. This finding potentially initiate the paradigm shift in the research field of healable materials. However, for the practical application, there still exist critical problems to overcome. In particular, a glass transition temperature of the healable polymer glass is around room temperature, hence its mechanical properties significantly change in response to temperature change. Additionally, the material has hygroscopic nature, which also results in softening of the materials.

In this internship, for solving this issue, series of polymer blends with different compositions were prepared from four different compounds. Their miscibility and thermal properties were characterized by differential scanning calorimetry and dynamic mechanical analysis. It was confirmed that polymer blends composed of immiscible polymers can be prepared thanks to hydrogen bonding. In addition, the hygroscopic nature of the healable polymer glass was successfully suppressed by incorporation of hydrophobic polymers.

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