The 1st JAIST World Conference (JWC2018)
at JAIST, February 27-28, 2018

Superhigh performance bioplastics having deformable rigid backbones

TATSUO KANEKO[1,*], KENJI TAKADA[1], NAOKI TAKAYA[2]

[1]*Graduate School of Advanced Science and Technology, Japan Advanced Institute of Science and Technology (JAIST), Nomi, Ishikawa, 923-1292, Japan*
[2]*Graduate School of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki, 305-8572, Japan*
*e-mail: kaneko@jaist.ac.jp

Keywords: cinnamate, high performance polyimide, surface energy, cell adhesion

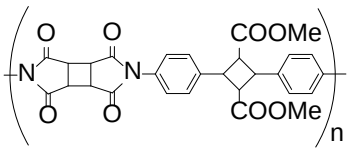

Figure 1. Typical structure of bio-based polyimide prepared from microbiual aromatic amino acid

Demand of high performance bio-based polymers has increased due to their excellent thermal, high chemical, good mechanical properties and environmental concerns. Conventional bio-based polymers have been derived from aliphatic polyesters and then the performances were very low and no remarkable functions were shown[1]. On the other hand, bio-based aromatic polyimides or polyamides cover one of the most vital classes of high performance polymers to be suitable for using as super-engineering plastics. Nevertheless, an aromatic diamine as one of the monomers has never been derived from microbes due to their incompatibility with microorganisms.[2,3]

Here we focused on bio-based super-engineering plastics of polyimides and polyamides derived from bioavailable aromatic diamines, which were photodimers of 4-aminocinnamic acid (4ACA) available from genetically-engineered *Escherichia coli*, and tetraacid. These polymers were processed into transparent films having high heat resistance (T_g > 270 °C, T_{d10} : ca. 400 °C), owing to rigid backbones. Some of polyamides showed superhigh mechanical strength over 400 MPa keeping good transparency, and high strain energy density over 200 MJ/m^3, based on the deformability of cyclobutanyl moiety. Low density was provided in the range of 1.18-1.38 g/cm^3. Then the presence bio-plastics can hopefully contribute to the sustainable society establishment where high-performance and light-weight materials should be utilized.

Acknowledgement The researches were financially supported by ALCA project (5100270) of JST and Grant-in-Aid for Scientific Research (B) (15H03864) of MEXT, Japan.

References

1) T. Kaneko, et al., *Nature Mater*., 5(12), 996-970 (2006)
2) P. Suvannasara, T. Kaneko et al. *Macromolecules*, 47(5), 1586-1593 (2014)
3) S. Tateyama, T. Kaneko et al. *Macromolecules*, 49(9), 3336-3342 (2016)