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Tunable mechanical properties of green solid films based on deoxyribonucleic acids HISAO MATSUNO, YUMA MORIMITSU, Kyushu Univ, NOBORU OHTA, HIROSHI SEKIGUCHI, Japan Synchrotron Radiation Research Institute , ATSUSHI TAKAHARA, KEIJI TANAKA, Kyushu Univ — Promoting green innovation to establish a worldwide low-carbon society is an urgent priority. We here show that solid films made from deoxyribonucleic acid (DNA) can be used as a structural material. The great advantage of DNA films over the ones made from synthetic polymers is that the mechanical properties are controllable, from glassy to rubbery, via semicrystalline by simply regulating the water content in the film. Why such unique mechanical properties can be manifested by the DNA films is determined from structural analyses using Fourier-transform infrared spectroscopy and wide-angle X-ray diffraction measurements. With increasing water content, the conformation of DNA was changed from A-form in an amorphous state to B-form in a partially packed one. DNA in the B-form became densely packed as the film was stretched. Also, DNAs were intermolecularly cross-linked using 2,5-hexanedione based on reductive amination induced by 2-picoline borane in aqueous phase. Cross-linking points were directly observed by atomic force microscopy. The tensile properties of cross-linked films were much better than those of non-cross-linked DNA films.

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