Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Effect of twist-orientation on mechanical properties of self-reinforced poly(lactic acid) screws in simulated body environment
MASATO SAKAGUCHI, SATOSHI KOBAYASHI, tokyo metropolitan university, COMPOSITE ENGINEERING LAB TEAM — Poly(lactic acid) (PLA) attracts much attention as a typical biodegradable polymer, and has been applied as a bone fixation device. As one of the methods to improve mechanical properties of PLA bone fixation device, orientations of molecular chains have been investigated. However, conventional uniaxial drawing could not improve mechanical properties along the other loading direction than the drawing direction, such as torsion. In this study, screw is treated as a bone fixation device. In order to improve torsional strength of a bioabsorbable PLA screw, twist-orientation method has been developed. PLA screw is prepared through a series of routes including extrusion molding, extrusion drawing, twist-orientation and forging. This screw was immersed in the phosphate buffer solution for 0, 8, 16 and 24 weeks, then shear strength, orientation function, crystallinity and molecular weight were measured. As a result, twist-orientation improves the initial torsional strength of PLA screw without the decrease in initial shear strength. In addition, the shear strength on twist-oriented screw is equivalent that of non-twist oriented screw during immersion until 24 weeks. This result shown that the twist-orientation does not decrease shear strength after immersion.

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Date submitted: 29 Oct 2015 Electronic form version 1.4