Strength of interface in bioresorbable poly-lactic acid/Mg fiber composites for orthopedic applications

Wahaaj Ali[1,2,3,]*, Alexander Kopp[3], Carlos González[1,4], Javier Llorca[1,4]

1. IMDEA Materials, C/Eric Kandel 2, 28906 Getafe, Madrid, Spain
2. Departament of Material Science and Engineering, Universidad Carlos III de Madrid, Leganés, Madrid 28911, Spain
3. Meotec GmbH & Co. KG, Philipsstr. 8, 52068 Aachen, Germany
4. Department of Materials Science, Polytechnic University of Madrid, 28040 Madrid, Spain

*syed.rizvi@imdea.org

In the last decade researchers have shown interest in bioresorbable magnesium reinforced Poly-L-latic Acid (PLA) composites to replace conventional non-degradable metallic implants in orthopedic application. Unfortunately, there is a lack of insight on the interfacial behavior between Mg and PLA which is necessary for optimal design of implant this material.

In this study, fabrication of bioresorbable composite of PLA reinforced with ultra-fine Mg (WE43) fibers of 100 microns in diameter is presented. Interfacial strength has been measured in their composite form exploiting a sophisticated and relatively accurate nano-indentation technique of push-out tests. The shear strength of the interface was measured by means of push-out tests in thin slices of the composite perpendicular to the fibers. It was found that the interface strength is 15.2 ± 1.4 MPa. While load-displacement behavior and SEM reveal nature of interface to be brittle. As the results of push-out test can be affected by constraining fibers, therefore non-isolated fibers were also pushed-out after random selection. It was found that constraint effect is negligible on the results of push-out test for Mg/PLA composites.