# Combination of nano-layer of silane and polymer coating as a method to improve biocompatibility of magnesium alloy

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**Abstract**

Recently, Magnesium (Mg) and its alloys have been investigated as promising metallic materials for biodegradable devices in the orthopedic field, due to their biocompatibility, low density and a high mechanical strength. However, the biodegradation/corrosion rate of Mg and its alloys currently available are too high. One of the methods to improve the initial corrosion resistance and cytocompatibility of Mg are silanization, biodegradable polymer coating. However, coating properties such as biocompatibility, water permeability, or mechanical strength, are keys for the success of this method.

In our previous research [1], nano-layer of silane prepared on the AZ91 substrate surface increased its surface hydrophobicity and improved cytocompatibility. Based on the $Mg^{2+}$ quantification, silanization does not influence the AZ91 substrate degradation under cell culture condition.

In this work, nano-layer of silane was employed to improve the interface strength between the Mg substrate and the biodegradable polymer via changing substrate surface hydrophilicity.

3-(glycidyloxypropyl) triethoxysilane (GPTES) was spin-coated on the castZM21 magnesium alloy, and then, poly-L-lactide (PLLA) is over-coated. This sample is referred to as GPTES+PLLA. For comparison, unmodified samples (castZM21), samples with silane coating alone (GPTES), and those with only polymer coating (PLLA) were prepared. The PLLA film thickness is about 0.2 µm. According to the XPS analysis, thickness of GPTES on the castZM21 surface is estimated as ~ 10 nm order. Nano-layer of GPTES slightly decrease water contact angle of the castZM21 surface from 62º to 60º and had no impact on suppression of corrosion. The PLLA coating decreases hydrophilicity to the level favourable for cell proliferation [2]. Results of a cell proliferation assay show that after 7 days of incubation, the PLLA and GPTES+PLLA coating successfully improved cell growth comparing to castZM21 and GPTES. This effect is more visible for GPTES+PLLA. Also no polymer detachment was observed.The higher improvement of cytocompatibility on GPTES+PLLA suggests the influence of silane nano-layer on the stability of polymer coating.

**References**

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**Figures**

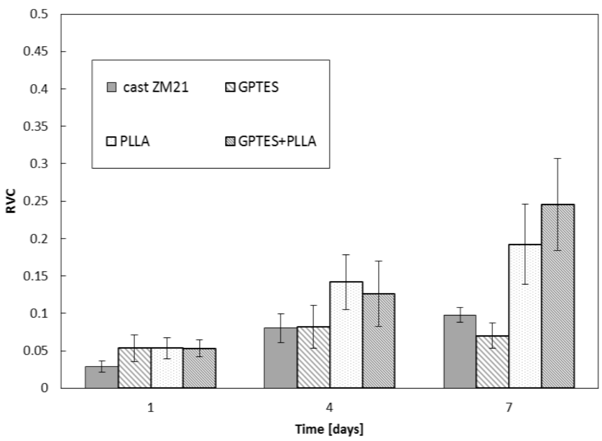


Fig.1 Proliferation of SaOS-2 cells on cast ZM21 substrate without/with silane, polymer, silane and polymer.