SURFACE ROUGHNESS AND WETTABILITY OF PEO-COATED MG ALLOYS IN DIFFERENT ALKALI SOLUTIONS

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INTRODUCTION

Magnesium (Mg) and Mg alloys considered as perspective materials for biodegradable implant development but fast and uncontrolled corrosion limited its clinical application. Plasma electrolytic oxidation (PEO) is a high-voltage electrochemical process that can provide protective coating over Mg implants. Alkaline silicate, sodium fluoride, and phosphate electrolytes are recently used for PEO due to impact on mechanical and protective properties of the coating. Additionally, PEO can provide porous surface topography that provide adequate environment for cell adhesion and proliferation.

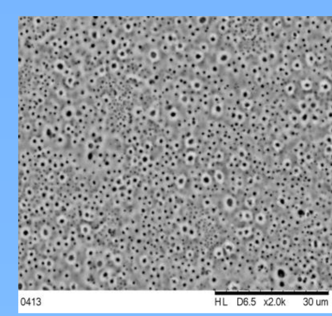
AIM

The objective of current study was to evaluate surface parameters of Mg after PEO in different alkali solutions.

METHODS

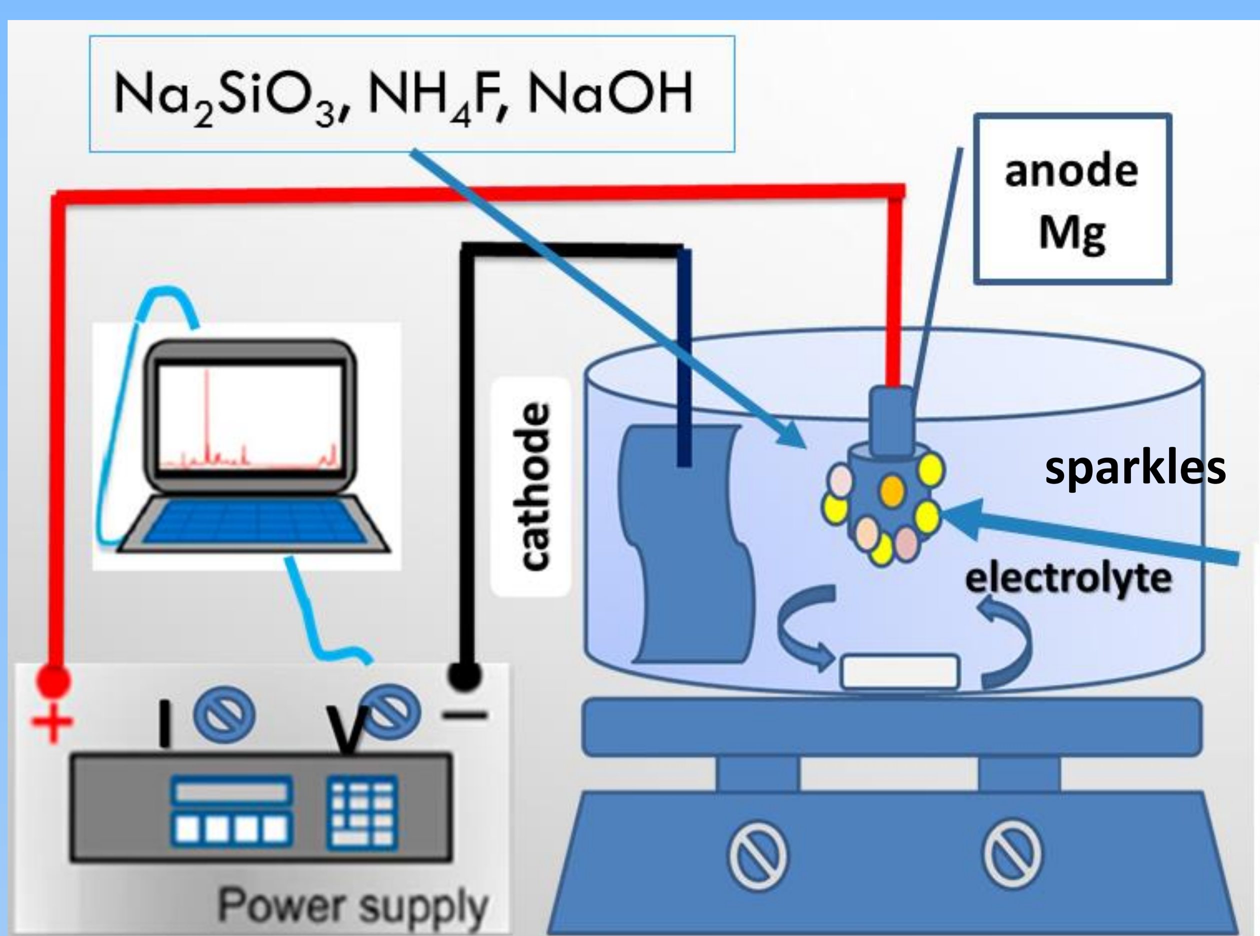
- Plasma electrolytic oxidation (PEO);
- Scanning electronic microscopy (SEM) (Surface morphologies);
- Contact angle (the energy of the surface, dispersion, hydrophilicity, hydrophobicity);
- Roughness.

SAMPLES Mg alloy, 1 cm^3 → **PEO modification treatment** →



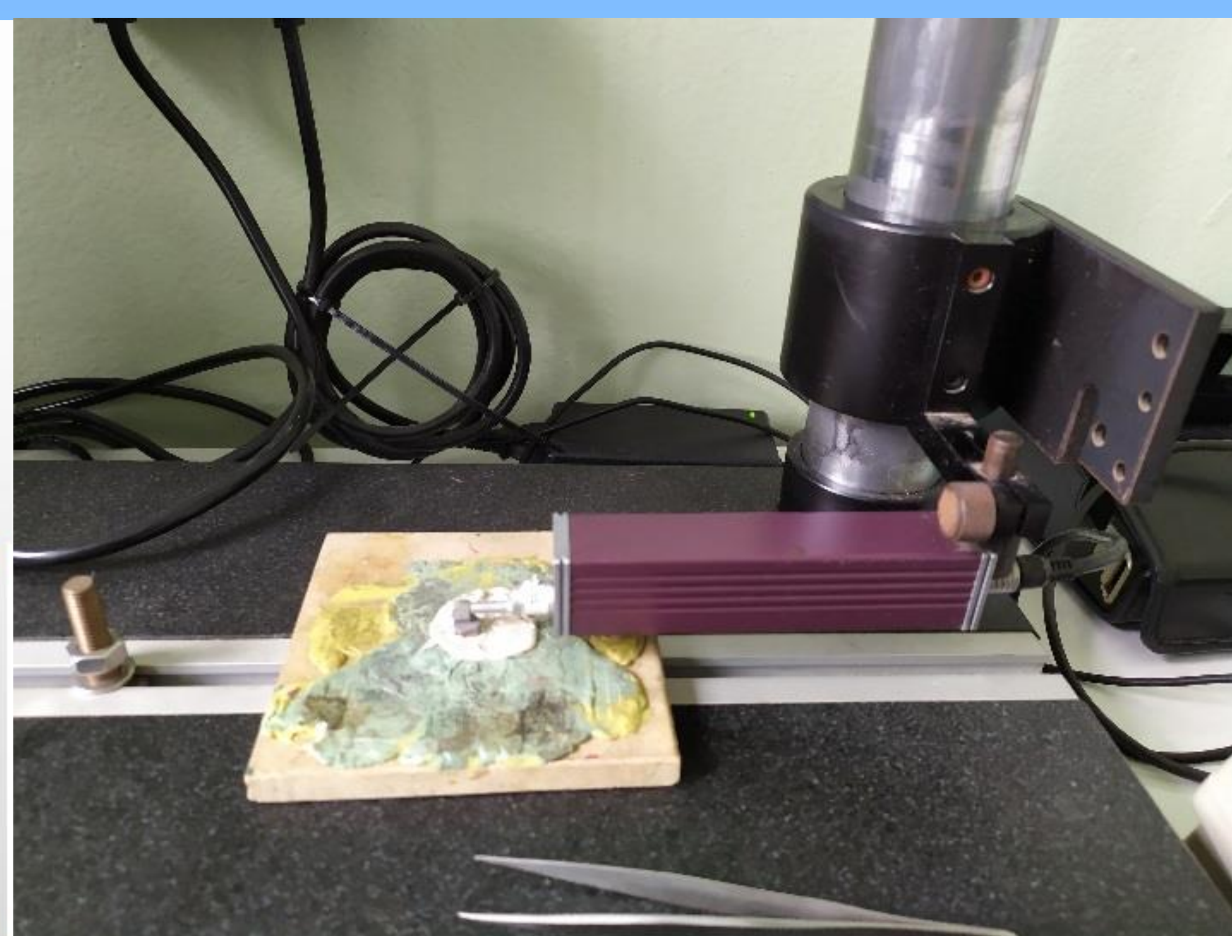
→ **Material characterization** → **SEM**, **Contact angle (CA)**, **Roughness**

PEO



current density - 0.1 A cm^{-2} and final voltage - 200, 250, 275 and 300 V for 10 min

Roughness



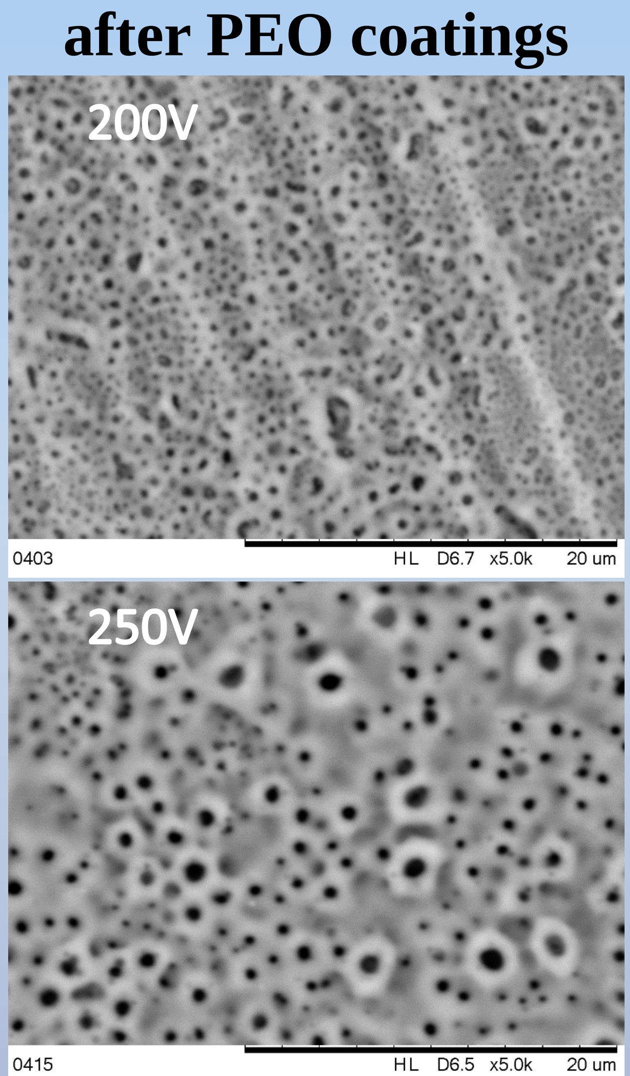
tactile stylus method using a surface roughness tester (Surftest SJ-301, Mitutoyo, Kawasaki, Kanagawa, Japan)

Contact angle

video-based optical contact angle measuring instrument (OCA 15 EC, Series GM-10-473 V-5.0, Data Physics, Filderstadt, Germany)

RESULTS

SEM images of the surface after PEO coatings

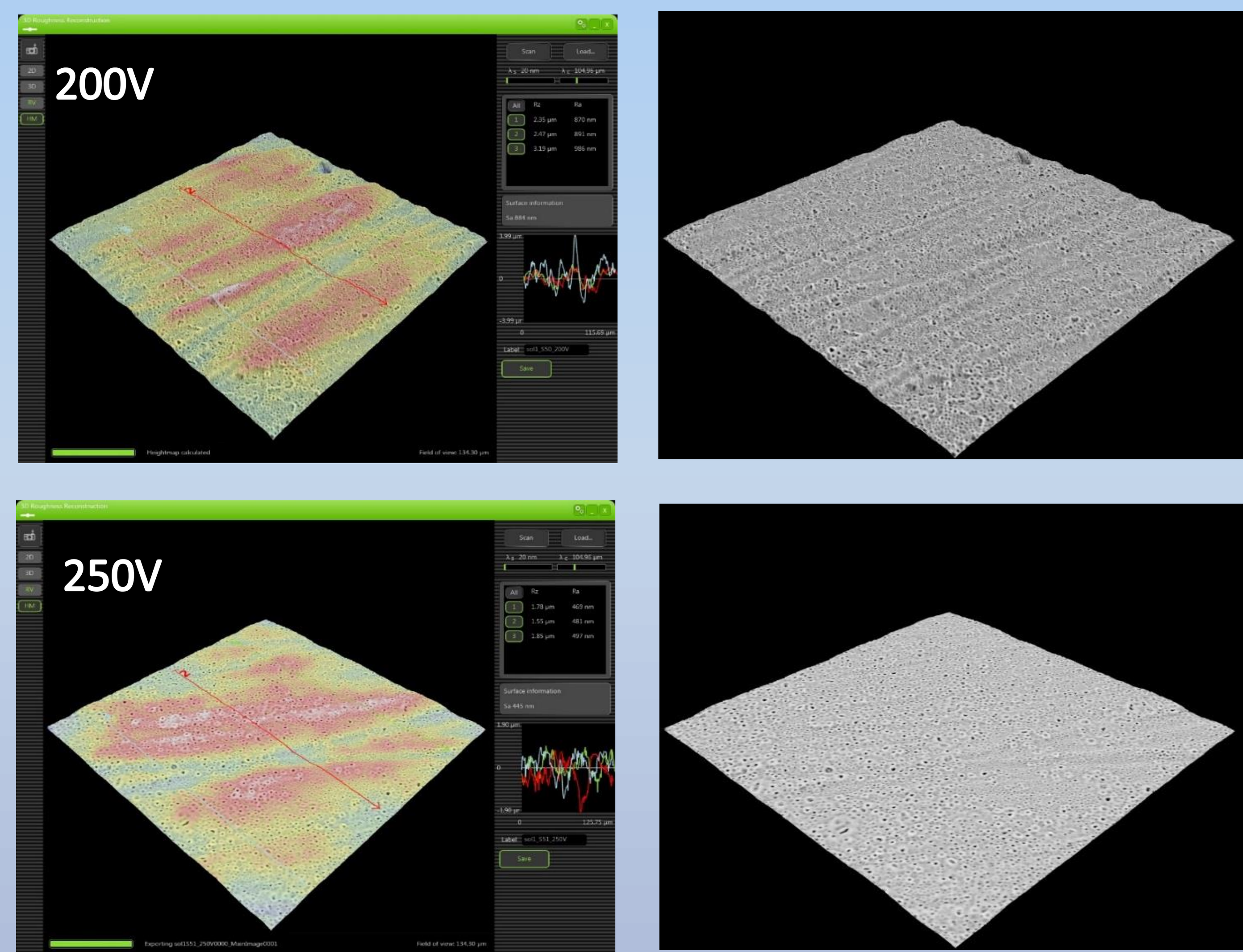


Characteristics of roughness and wettability of the coatings

Samples		Ra, µm	CA, °
Sol 1 Na_2SiO_3, NH_4F and NaOH	200V	0,43±0,02	26.22
	250V	0,39±0,01	22.7
Sol 2 Na_2SiO_3, NH_4F, and $Ca(OH)_2$	250V	1,67±0,08	16.61
	300V	2,10±0,15 *	0
Sol 3 Na_2HPO_4 and NaOH	250V	1,09±0,63	70.73
	275V	0,87±0,08	59.72
	300V	2,88±0,3 *	94.21

* - p<0.0001

The surface roughness of the surface after PEO coatings



The results showed statistically significant increases ($p < 0.0001$) the surface roughness in the case of Sol 2 300 V (2.10±0.15) and Sol 3 300 V (2.88±0.3) samples among obtained coatings.

The contact angle for the samples Sol 1 and Sol 2 characterized as the surface with high wettability. Samples Sol 3 refers to the surface with low wettability.

CONCLUSION

The Mg treated under Sol 2 with final voltage 300 V showed the higher roughness value and complete wettability. The hydrophilicity of obtained coating and high roughness made them suitable for biomedical applications.

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