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Forming quality, mechanical properties, and anti-inflammatory activity of additive manufactured Zn–Nd alloy

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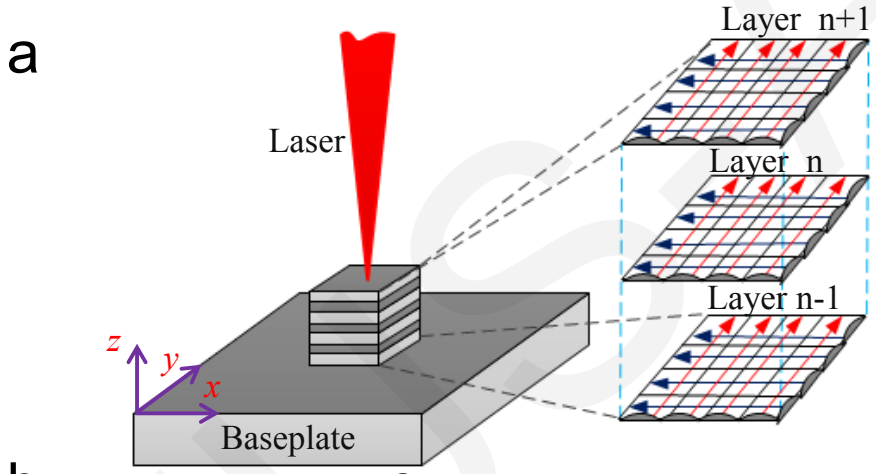
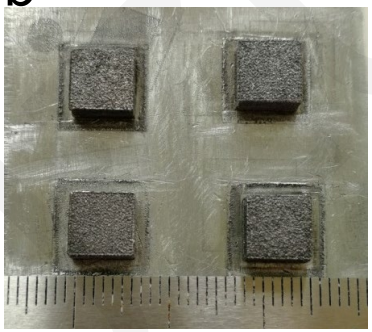
Laser Additive Manufactured Parts



Laser scanning strategy

b



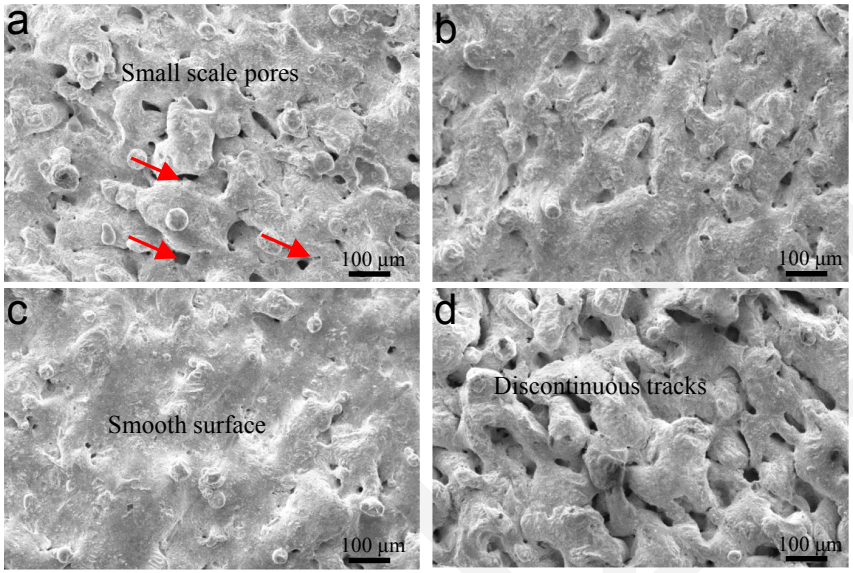
c

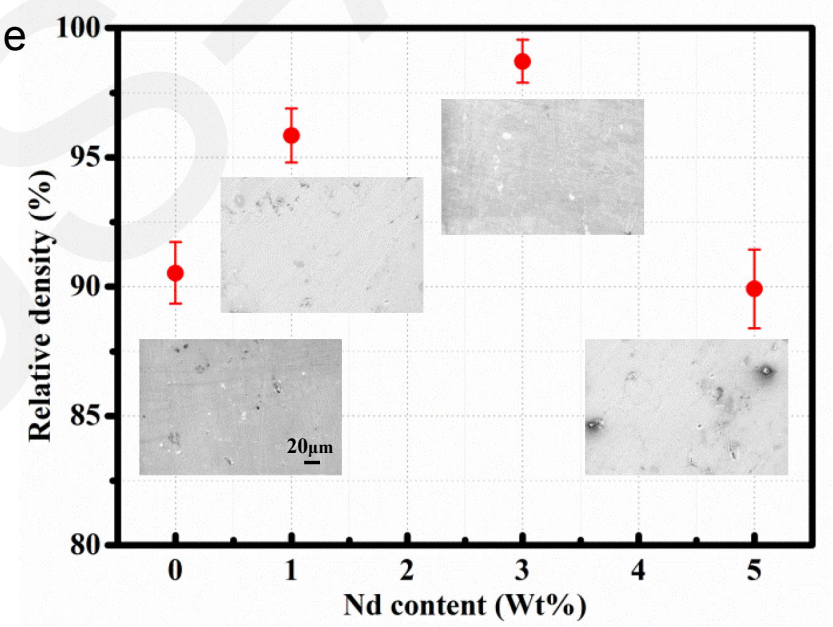
Zn-*x*Nd (x=0, 1, 3, 5 wt.%) parts

Tensile samples

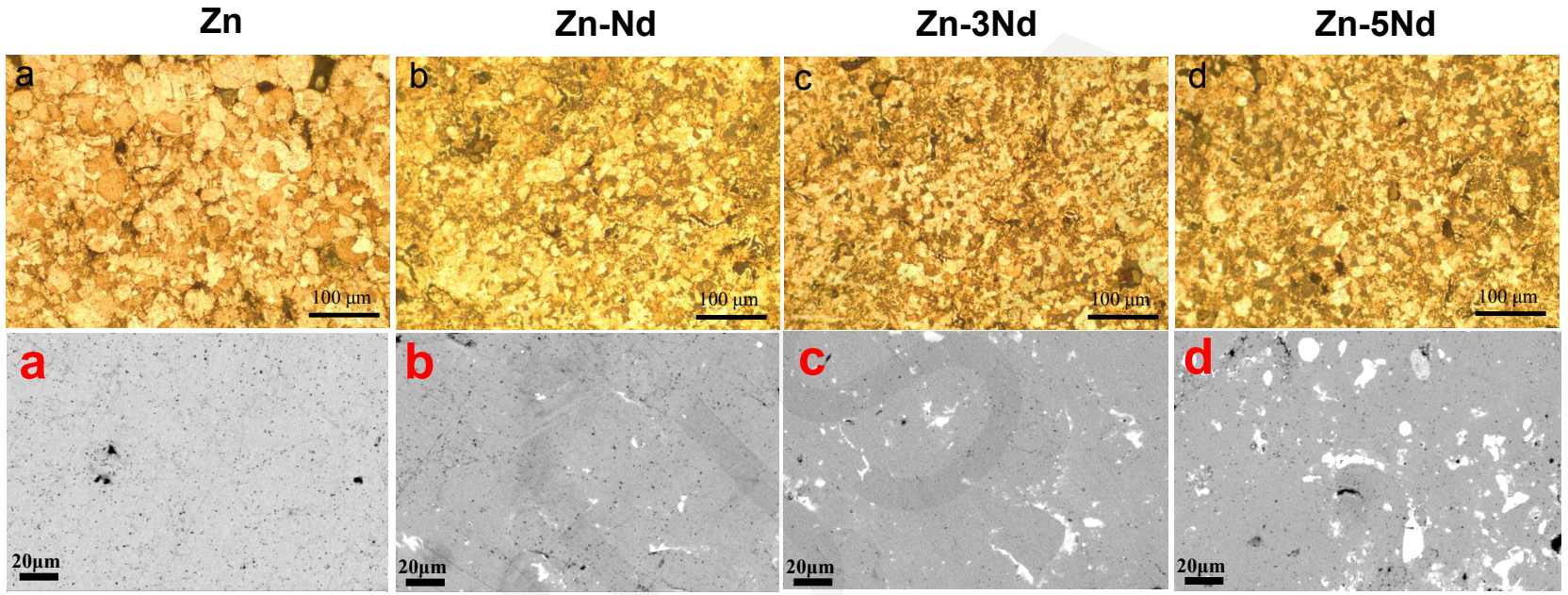
Forming Quality

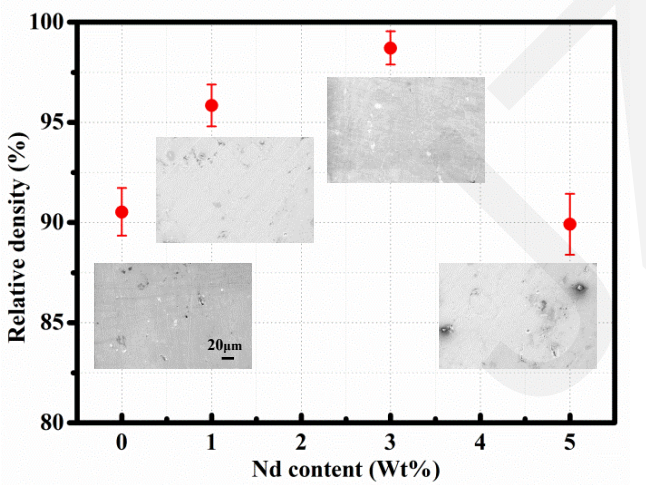
■ The surface morphologies and the densification rates of laser additive manufactured Zn-xNd parts.

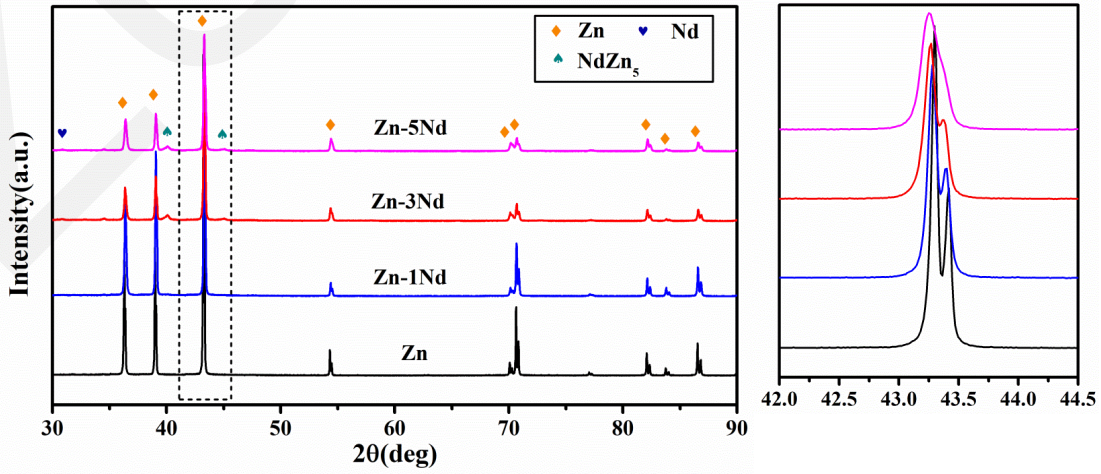




Microstructure Evolution







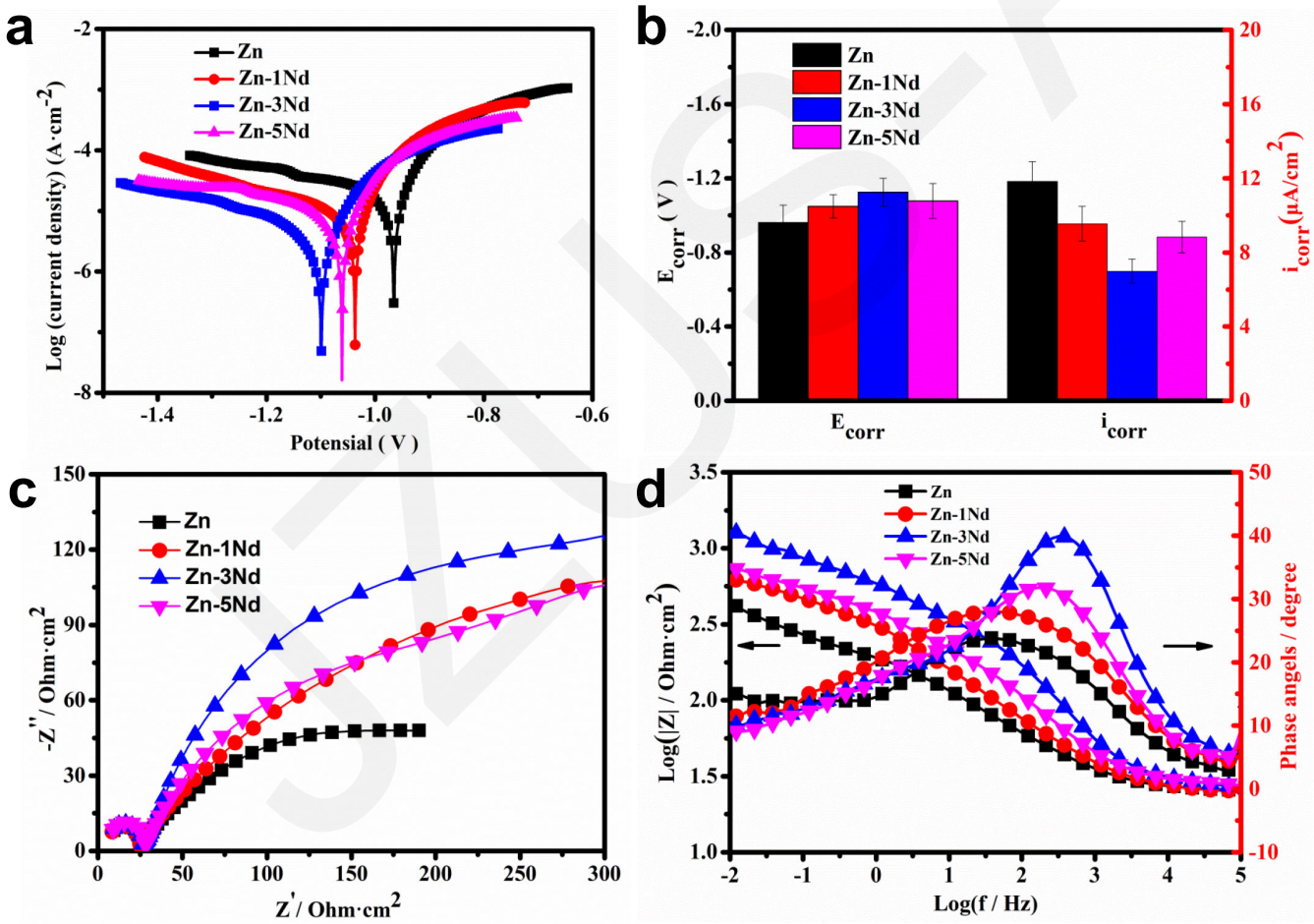
Mechanical Properties

Table .1 Tensile properties and hardness of laser additive manufactured Zn-*x*Nd parts.

Samples	Zn	Zn-1Nd	Zn-3Nd	Zn-5Nd
Ultimate tensile strength (MPa)	66.5±6.5	96.3±4.9	119.3±5.1	107.3±6.2
Elongation (%)	10.2±2.3	8.7±1.9	6.7±1.6	4.3±1.8
Elastic modulus (GPa)	58.4±8.6	67.4±7.7	79.4±5.3	85.4±6.1
Hardness (HV)	56.5±6.7	67.2±5.1	76.2±4.1	82.2±5.4

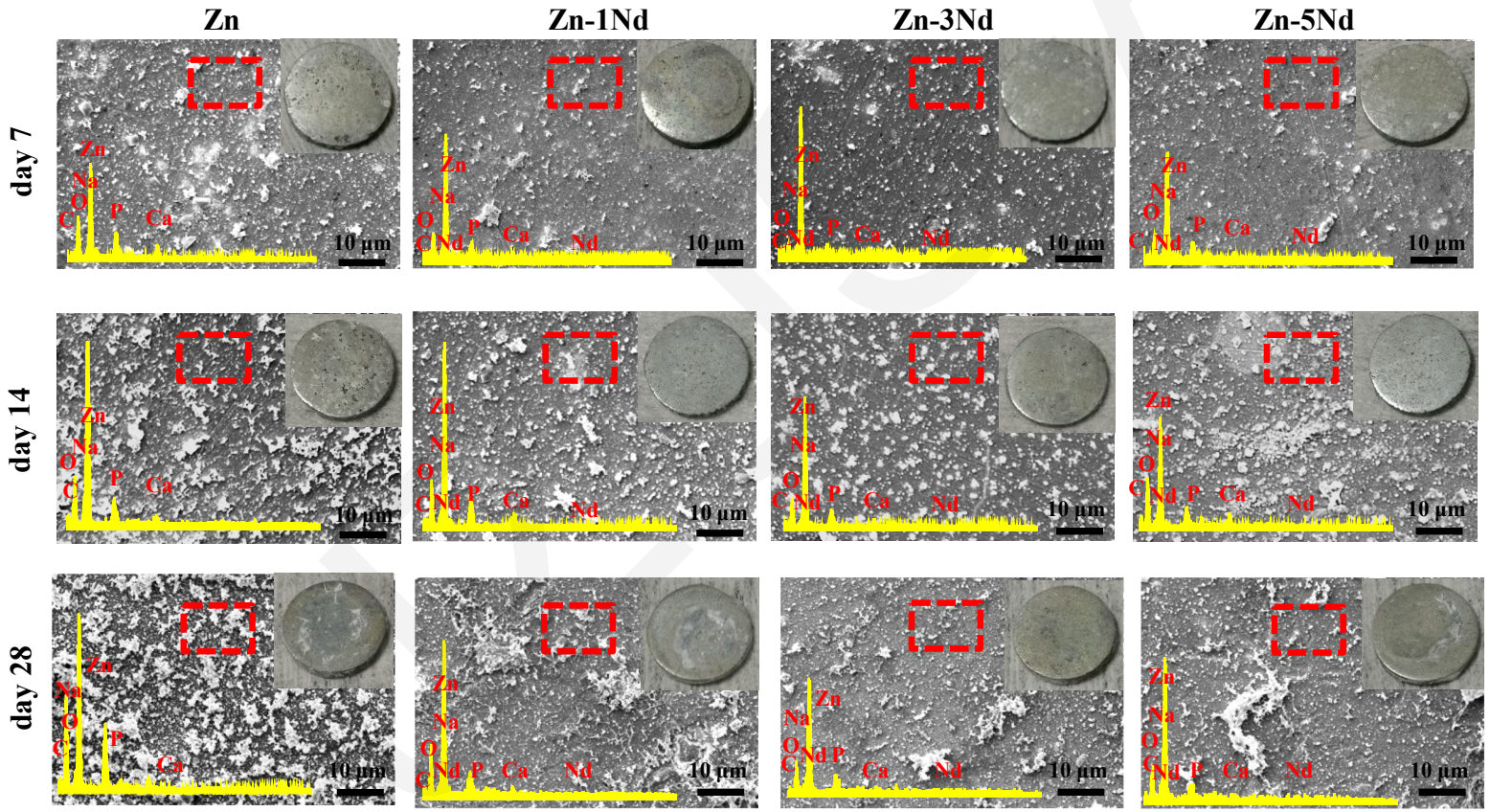
Corrosion behavior

■ Electrochemical testing results of laser additive manufactured Zn-xNd parts in SBF



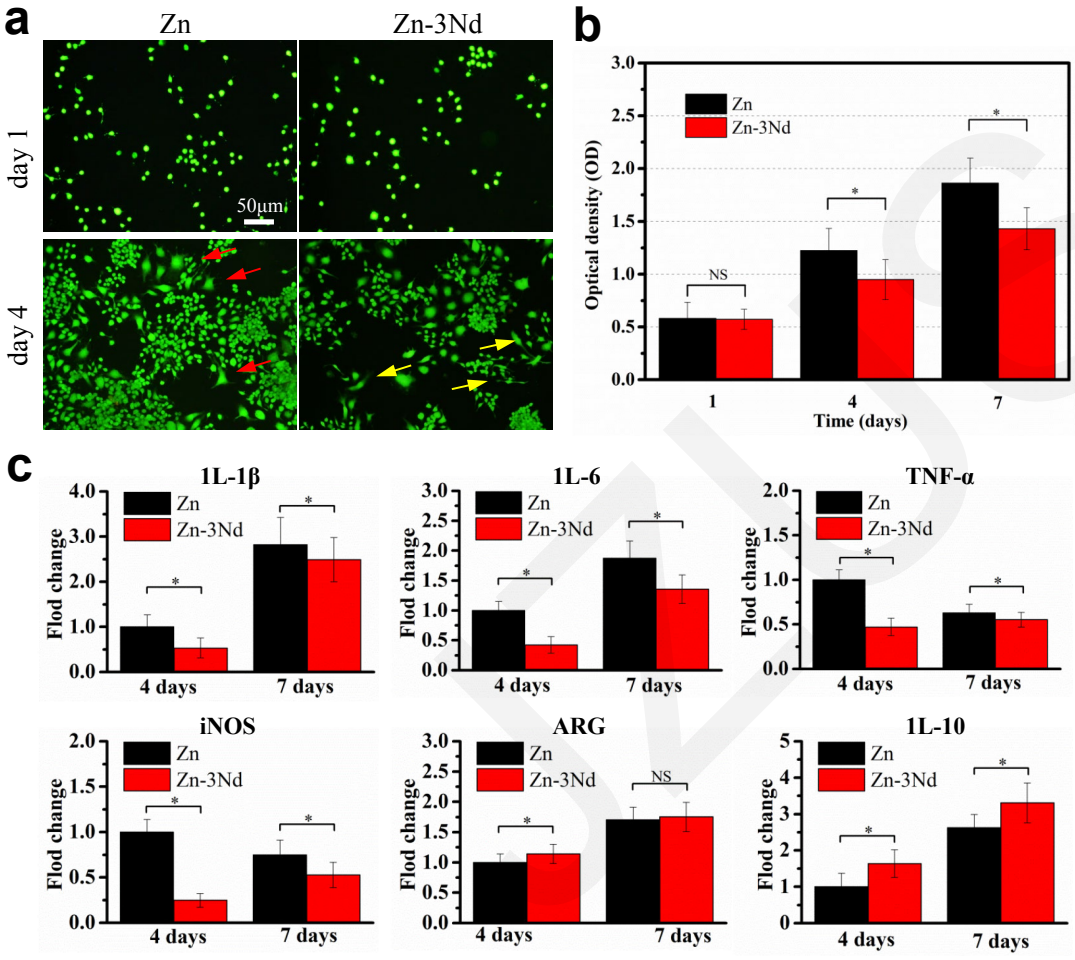
Corrosion behavior

- SEM images showing corrosion surfaces of Zn-*x*Nd parts after immersion in SBF

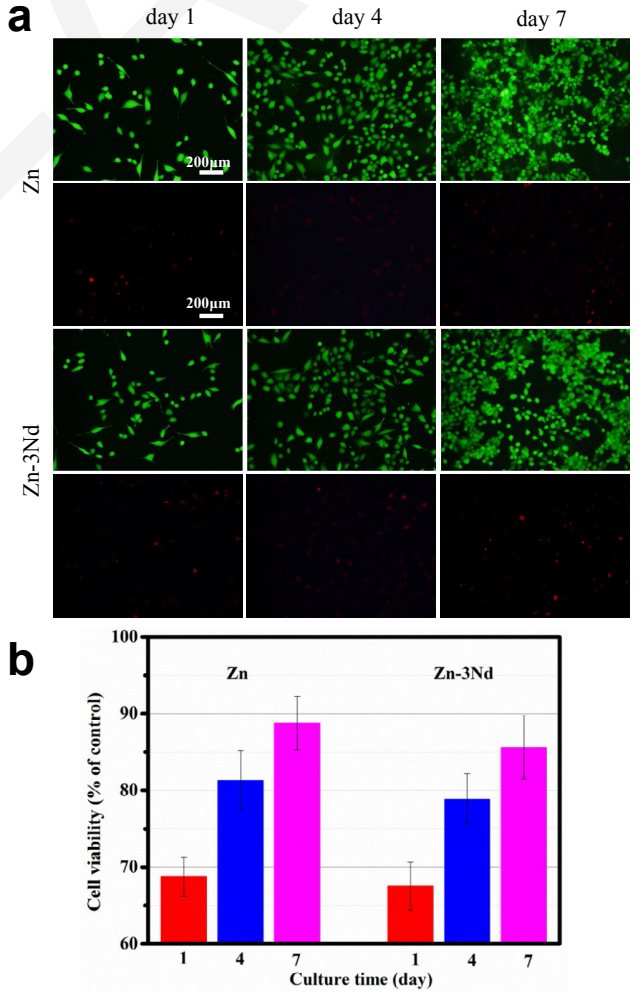


Biological Properties

Evaluation of anti-inflammatory activity



Cytotoxicity assay



Conclusions

- The Nd alloy treatment improved the formation quality of the laser additive manufactured Zn-xNd parts, which achieved a high densification rate of 98.7%.
- Nd addition contributed to grain refinement and second phase strengthening and second phase strengthening. The ultimate tensile strength of the Zn-3Nd parts was enhanced to 119.3±5.1 MPa.
- Nd alloying inhibited the release of pro-inflammatory factors and promoted the release of anti-inflammatory factors, endowing the Zn-Nd parts with good anti-inflammatory activity. Cell culture tests also indicated that they showed no obvious cytotoxicity.