





Study and development of bioresorbable batteries

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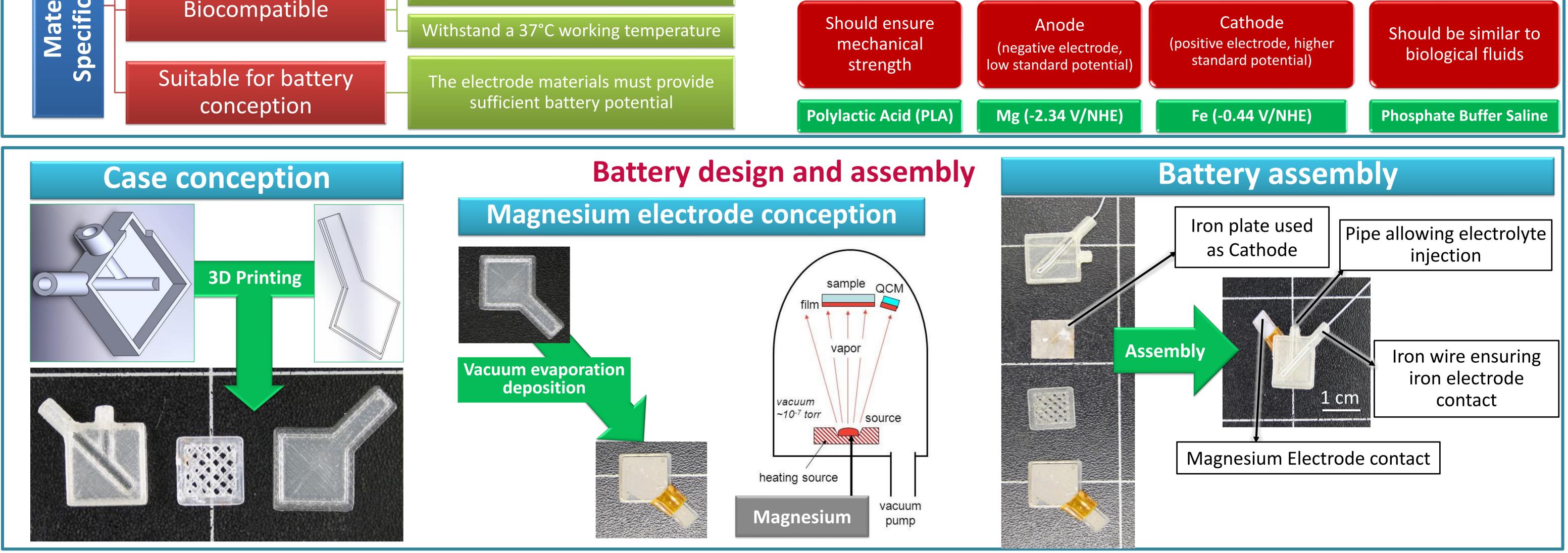
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Project Framework

Main objective :

To study and design a battery capable of supplying a low power electronic device inside the body (for a temporary in situ medical monitoring of a patient, for instance) and which would slowly degrade without leaving harmful traces after use and eventually show its feasibility.

Chosen Materials					
	Bioresorbable	Biodegradable	4 functions to be fulfilled for 4 materials with their own characteristics		
s ons		Degradation products elimination by natural paths	Encapsulating	Electrodes	Electrolyte
erials catio		Harmless for the human body		(with sufficient potential difference)	



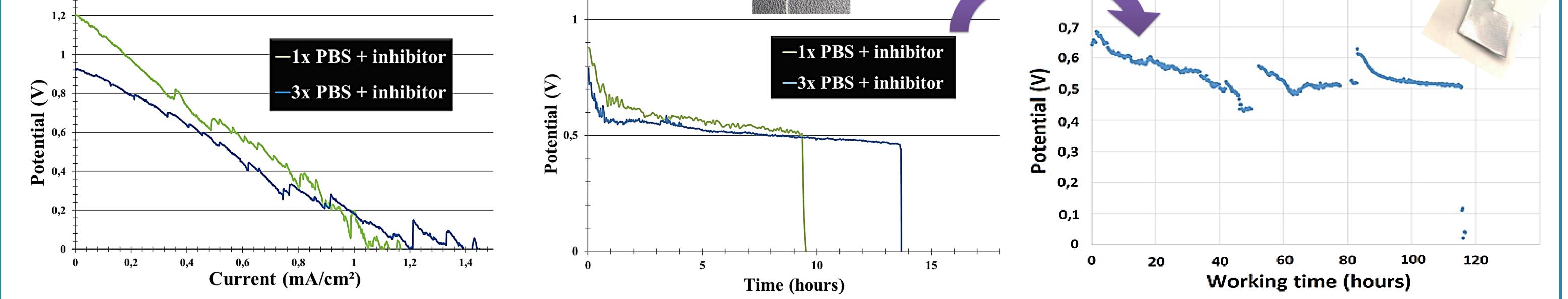
Battery degradation and lifetime

PLA degradation

Magnesium is highly oxidable PLA undergoes a bulk degradation caused ←1x PBS in aqueous media Sample used to observe 100 — рН 11 by water hydrolysis mechanical degradation caused by ester bonds 📥 3x PBS with inhibitor In this condition, battery will $\operatorname{Im}\left(\Omega\right)$ cleavage only work for a few hours $R \longrightarrow C \longrightarrow O \longrightarrow R' + H_2O \longrightarrow$ → R — C — OH + HO — R' N A corrosion inhibitor is 116% (IPa) needed 114% 1500 riation 112% **S** 1300 110% Π Use of sodium benzoate $Z \operatorname{Re}(\Omega)$ **b** 1100 • ٠ Real part of EIS graph let us know which electrolyte is the 104% 5 • Sample 1 n D O__O-Na⁺ 102% best candidate to prevent magnesium oxidation Ma Sample 2 100% 98% As much as magnesium is oxidizing, iron is galvanically protected from corrosion 25 **Immersion Time (days) Immersion time (days)**

Electrochemical performances





Conclusion and prospects

Biodegradable and biocompatible battery conception has been shown.

If Λ This battery is able to dispense 0,5 Vat a discharge current of 100 μ A/cm² for several days.

Electrodes degradation

The discharge/lifetime of this battery has been optimized.

A localized corrosion separates the magnesium electrode from its contact connection, which induces an early shutdown of the battery's operation. It's the main point to optimize.