

OPTIMISATION OF THE CORROSION RATE OF IRON-BASED ALLOYS FOR BIORESORBABLE STENT APPLICATIONS BY SURFACE ACIDIFICATION

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INTRODUCTION: Biodegradable materials progressively become of interest for stent applications. Indeed, a stent has fulfilled its task after 6-12 months and is therefore not needed anymore. Bioresorbable stents could be a way to prevent late complications such as late thrombosis [1]. Stents need to be mechanically strong, making steel a good candidate. However, its corrosion rate is too low. Furthermore, during the corrosion of the stent in the blood environment, different layers form on top of the metal, hindering the oxygen diffusion towards the metal [2]. A way to increase the corrosion rate thus needs to be found. The pH of the environment greatly influences the presence of these layers; an acidic pH favours their dissolution [2,3,4], which could help in activating the corrosion. However, the blood environment needs to keep a pH close to physiological pH (7.4) and thus only the near stent surface can undergo an acidification without affecting the blood system too much. The present work investigates the influence of hydrogen in Fe-based alloys on the corrosion rate.

METHODS: Hydrogen charging was conducted either electrochemically or thermally on Fe-based alloys. The influence of the hydrogen concentration as well as the presence or not of hydrogen traps on the corrosion mechanism in SBF (simulated body fluid) is assessed by means of immersion tests. These tests allow to mimic closely what happens *in vivo*. Potentiodynamic polarisation tests were also conducted to highlight the influence of the chemical composition on the corrosion rate. Tensile tests were also carried out.

RESULTS: The content of hydrogen influences the corrosion rate in a way highlighted by immersion tests and characterization of the surface layers.

DISCUSSION & CONCLUSIONS: Bioresorbable stents made of steel could become a solution to avoid late complications due to the presence of a foreign body in the blood environment. In order to accelerate the corrosion

of steel, surface acidification could be implemented, leading to a dissolution of the corrosion layers that hinder the oxygen transport and thus decreasing the corrosion rate.

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