Reduction of graphene oxide on biomedical grade CoCr alloys. A comparison of chemical and electrochemical methods

Luna SÁNCHEZ LÓPEZ[1], Lucía CASTRILLEJO ROBLES[1], Belen CHICO[1], M Lorenza ESCUDERO[1], Rosa M LOZANO[2], M Cristina GARCIA-ALONSO[1]

[1] National Center for Metallurgical Research/ Spanish National Research Council (CSIC), Spain
[2] Center for Biological Research – Margarita Salas/Spanish National Research Council (CSIC), Spain

Surface modification of CoCr biomedical implants arises for increasing durability of mechanical and corrosion properties in order to minimize adverse biological reactions in the human body. In this study, we focus on the reduction of graphene oxide as promising method of tailoring CoCr surfaces for further functionalization in order to regulate the responses of macrophages and osteoblasts contacting modified CoCr surfaces. Reduction of graphene oxide (GO) was performed on biomedical grade CoCr surfaces by using both electrochemical and chemical methods. Electrochemical reduction of GO was carried out by cyclic voltammetry after immersion of silanized CoCr surfaces in the aqueous solution of graphene oxide (4 mg/ml) at room temperature. Cyclic voltammetry was performed from -2,1 V to -0,5 V, vs. Ag/Ag/Cl, for 5 scans at 10 mV/min. Chemical reduction of GO was performed through ascorbic acid by maintaining a controlled temperature below 100ºC. The final suspension was dropped onto the silanized CoCr surfaces and allowed drying at room temperature. An extensive characterization of the modified CoCr surfaces has been performed by comparing both reduction methods. The corrosion performance of modified CoCr surfaces was assessed by the measurement of the corrosion potential and Electrochemical Impedance Spectroscopy (EIS) in 3 G/L hyaluronic acid solution.