Influence of the sterilization process on the surface state of biomedical alloys

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Biomedical implants and, in general, medical devices, must be sterile before implantation and contact with human body in order to eliminate and stop the production of microorganisms such as bacteria, spores and fungi. Sterilization can be then considered the last step of the surface modification in the manufacturing process of biomedical devices. Its importance is related to the fact that sterilization has to remove the maximum amount of microorganism without compromising their key surface properties that may influence their interaction with the surrounding tissue (i.e. electrochemical reactivity). To do that, different physical and chemical techniques are available nowadays and their use depends on the material properties and the final application of the device. Among them, gamma radiation (G), steam autoclave (AC), ultraviolet irradiation (UV), dry heat and ethylene oxide (EO) are widely used in the biomedical field.

The aim of this work is to characterize the corrosion behavior of biomedical materials typically used in hip and knee joint implants (CoCrMo and titanium alloys) processed by different sterilization methods (ethanol, steam autoclave, UV-light and Gamma-radiation) by electrochemical techniques and surface analysis. The results showed that sterilization modifies the surface properties of the studied biomaterials, their corrosion resistance and the kinetics of the electrode reaction for oxygen reduction. The influence of the sterilization process on the cathodic kinetics is especially relevant in their clinical application when implanted in the human body and subjected to the combined action of wear and corrosion. In that situation, the influence of the metal surface state on the cathodic kinetics may modify the adsorption phenomena and the metal ion release.