

Surface roughness analysis of NiTi alloy in electrical discharge coating process

Abstract

Nickel-Titanium (NiTi) alloys, most widely known as nitinol, are presently employed in many micro-engineering applications such as coronary stents of medical implants due to their unique properties (shape memory effect and superelasticity). However, non-optimized surface finishing attributed a significantly high potential of nickel exposure after a long time of application. Releasing of nickel ion to the body environment can be harmful and toxicity resulting in adverse health as well as degrading the material biocompatibility. It is widely known that controlled surface roughness play a vital role in the formation of new bone ingrowths around implant. In this study, surface modification of NiTi alloy was used through electrical discharge coating (EDC); an adaptation of electrical discharge machining. The potential of EDC in which can facilitates the production of hard coatings may exploit the phenomena for the attachment of desirable materials onto the surface of materials. Therefore, the aim of this paper is to present a robust method (two levels of full factorial design and ANOVA) to determine the desired parameters and significant factors based on the surface roughness of the machined surface. Manipulation of parameters set up such as gap voltage, discharge duration and pulse interval and the current were employed and a reverse polarity was selected for this experiment. The results demonstrated that the most significant factors influence the surface coating performances are the discharge duration, current, gap voltage as well as the interaction between gap voltage and discharge duration.