

Abstract

Physical vapour deposition (PVD) is a surface modification method which is used nowadays to improve hardness, corrosion and wear resistance of materials used in the industry, including biomedical applications. The aim of this work is to choose within six coatings (CrN, TiN, Au, TiAlN, DLC, ZrN), deposited via arcing and sputtering PVD techniques and used as standard processes at EC Europ Coating GmbH, those, which can be applied on stent made of nickel titanium alloy (nitinol, NiTi) for treatment of tracheal stenosis. Protection barrier is needed for NiTi due to the risk of Ni release which can act harmfully for the human beings. The requirements that have to be fulfilled by such coatings were stated as follows: biocompatibility, strong adhesion to the substrate material, improvement of corrosion resistance of the substrate material and long term use. Firstly, preliminary tests with steel samples of different geometries were carried out and the coatings were compared by their thickness, surface roughness, friction, wear and corrosion properties. Secondly, selected coatings (CrN, TiN, DLC and ZrN) were applied on nitinol specimens and examined regarding their adhesion to the substrate, corrosion and performance in case of deformation, which was supported by confocal microscopy and scanning electron microscopy (SEM) equipped with energy-dispersive X-ray spectroscopy (EDX). All four coatings demonstrated sufficient adhesion to the substrates with HF 1. No corrosion was registered for CrN, DLC and ZrN. Some corrosion pattern was found on TiN coating. However, cracks are generated during deformation due to brittleness of hard PVD coatings, which propagate down to the substrate material, revealing the NiTi surface. Four coatings (CrN, TiN, DLC and ZrN) can be used for further investigations using standard process parameters during PVD procedure, while for Au and TiAlN coatings the parameters need to be optimized in order to improve wear and corrosion resistance.