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Design of TiO_xN_y for Developing Layered Stent Technology

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Extended Abstract

Stents are medical devices that are increasingly used in medical practice. Unfortunately, existing materials present certain disadvantages and lead to high failure risk. In this context it is necessary to develop new materials or to improve the existent ones by functional coatings. Titanium based stents exhibit reasonable surface properties and, if coated with a titanium oxynitride layer their performances for both medical [1-3] and engineering applications [4-6] can be further improved. Based on numerous works, stents coated with a TiOxNy film, exhibit superior clinical performance compared with uncoated stents especially due to the low adherence of platelets and fibrinogen [7,8]. In this study, the synthesis of TiO2 nanopowders was carried out by three different routes, in order to optimize the N:O ratio, in particularly, and thus to design the characteristics of the obtained nanopowders. The first synthesis route involved the chemical modification of the titanium dioxide (anatase form), by exposure at the action of ammonia 25% under magnetic stirring for 12h, followed by drying at 80°C overnight. TiOxNy nanoparticles were obtained with average particle size of 20-30nm, but also particles as large as 100nm in diameter can be identified. The second synthesis route involved in hydrolysis of titanium isopropoxide in concentrated ammonia. Hydrolysis was carried out by maintaining titanium isopropoxide in NH4OH (25%) for 12h, under magnetic stirring, followed by drying at 80°C overnight. It should be noted that the hydrolysis is practically instantaneous. TiOxNy nanoparticles were obtained with a broader particle size distribution with particles starting from 5-10nm to particles larger than 100nm in diameter. The third synthetic route involve the hydrolysis of titanium isopropoxide with the ammonia vapour followed by drying at 80oC, overnight. It should be noted that the modification of the morphology of the particles are independent and as a result of the treatment that has been exposed to moist powder is practically negligible. TiOxNy nanoparticles were obtained with particle sizes of 5-10nm, the tendency of agglomeration being very high. The N:O ratio was in the range 1:20 to 1:10 being adequate for manufacturing coated stents.

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