**Αγγλική Περίληψη**

Nowadays, a wide range of polymers can be applied in the fields of Nanotechnology and Nanomedicine. Novel biodegradable polymers are able to form matrices that cover implants before their insertion into the patients. These matrices can be loaded with various drugs and as an outcome they may act as potential drug delivery systems. In particular, such polymeric constructs gradually degrade inside the host organism releasing specific amount of drug in a controllable way. These drug eluting polymeric matrices can be used as coatings for cardiovascular stents and medical implants, in order to inhibit thrombosis and to restore the natural tissue healing faster while at the same time minimizing possible harmful reactions, such as inflammation, caused by immune system responses of the host. Hence, high drug delivery capacity, release of drugs in a controllable manner is the main challenges to be addressed in this study aiming to future clinical applications. Herein, we developed an experimental procedure to fabricate biodegradable polymeric coatings in a multi-layer configuration, made of Poly (DL-lactide-co-glycolide) (PLGA) and Polycaprolactone (PCL) by spin coating technique. The matrices were loaded with an antiplatelet drug, dypiridamole, to inhibit clotting. Atomic Force Microscopy (AFM) that was the main characterization tool and Spectroscopic Ellipsometry were implemented for surface and optical characterization of the systems. Finally, Spectrophotometry was used in order to study the behavior and the drug release rate of the above systems during a period of 3 weeks. The study demonstrated that the single layers of PLGA are atomically smooth, and spherulites are formed in PCL films. In addition, it was revealed that not only high nanoporosity was evident in the novel, multi-layer coatings, but also it was controllable by tuning the growth parameters. Platelet adhesion studies based on AFM observations indicate the anti-platelet effectiveness of the dypiridamole-loaded matrices, which inhibit platelets tendency to aggregate, versus non-drug loaded ones, which is essential for cardiovascular and other medical implants. The drug release studies show that the dipyridamole-loaded films are characterized by a triphasic elution profile. These findings indicate the potential application of the above construct as platforms for drug delivery and controlled drug elution with the form of coatings that cover medical implants.