Biocompatibility andantibacterial behaviors of TaON(porous)/TaN/TaN-Ag/Ta multi-layered thin films

Jang-Hsing Hsieh [1], S. C. Lin [1], and C. C. Hsu [1]

[1]Ming Chi University of Technology, Taiwan

In this study, a triple-layered thin filmstructure was designed and fabricated in order to realize porous and tunableTaOxNy thin films with enhanced biocompatibility and antibacterial behavior. Inthe design of film structure, the top layer was made of porous and tunableTaOxNy. The porous structure was obtained from TaOxNy-Cu (>50 at.%) thinfilms deposited by reactive sputtering. After the film was annealed by usingRTA (1st annealing), the Cu phase was etched away to form TaOxNy networkstructure. The bottom layer was TaN-Ag (11 at.%) which is used as a Ag sourcelayer. It also provided toughness and hardness. A thin TaN film was insertedbetween porous TaOxNy layer and solid TaN-Ag layer, and used as Ag diffusioncontrol layer. The function of this layer was to withstand the 1st annealing,then, during the 2nd annealing, to let certain amount of Ag diffusive to theporous TaOxNy layer, and formed Ag nanoparticles. The films fabricated based onthis design were studied systematically on their mechanical properties, Agparticle formation, as well as pore size and morphology. Finally, antibacterialproperty and biocompatibility of these films were studied in terms of O/Nratio, dealloying process, and Ag diffusion control. The relationships amongO/N ratio, Ag nanoparticle formation, porosity, and bio-reactions will be discussedand reported systematically.