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Surface of cavitation-peened Ti-6Al-4V ELI rod for biomedical applications

Titanium alloys are widely used for biomedical applications because they exhibit both high strength and high biocompatibility, while the wear-related properties are relatively poor. Therefore, the improvement of wear-related properties is desirable for the titanium alloys. For example, fractures of spinal fixation devices, which consist of three components such as rod, screw, and plug, often occur at the contact between the rod and the plug or screw because they are probably caused by fretting fatigue and fretting wear. Therefore, it is preferable to increase the resistance of fretting fatigue and fretting wear on the surfaces of titanium alloys when they are used as a material for spinal fixation devices. In this case, cavitation peening treatment is expected to be a clean and effective surface modification technique; it is performed by high-speed water jet in water and the material surfaces are impacted by collapsing cavitation bubbles, leading to work hardening with introduction of compressive residual stress. Therefore, the cavitation peening treatment was conducted on the surface of spinal rod made of Ti-6Al-4V ELI, which is the most representative titanium alloy for biomedical applications, and the treatment parameters were optimized in order to obtain the peening benefit effectively. The results revealed that the roughness was increased, but the compressive residual stress was introduced successfully on the surface of spinal rod. It indicates that the durability of spinal fixation device made of Ti-6Al-4V ELI is expected to be enhanced by the cavitation peening treatment.

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