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Surface Nanocrystalline and Hardening Effects of Ti–Al–V Alloy by Electropulsing Ultrasonic Shock

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Abstract : The effect of electropulsing ultrasonic shock (EUS) on the surface hardening and microstructure of Ti6Al4V alloy was studied. It was found that electropulsing improved the microhardness dramatically both in the influential depth and maximum value, compared with the only ultrasonic-shocked sample. It's indicated that refined surface layer with nanocrystalline and improved microhardness were obtained on account of surface severe plastic deformation, dynamic recrystallization (DRX) and phase change, which was implemented at relative low temperature and high strain rate/capacity due to the coupling of the thermal and athermal effects of EUS. It's different from conventional experiments and theory. It's discussed that the positive contributions of EPT in the thermodynamics and kinetics of microstructure and properties change were attributed to the reduction of nucleation energy barrier and acceleration of atomic diffusion. Therefore, it's supposed that EUS is an energy-saving and high-efficiency method of surface treatment technique with the help of high-energy electropulses, which is promising in cost reduction of the surface engineering and energy management.

Keywords : titanium alloys, electropulsing, ultrasonic shock, microhardness, nanocrystalline
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