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Abrading Increases Oxygen and Hardness of Titanium Surface

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Abstract:
CP Ti was mirror-polished and then abraded with waterproof SiC papers of two different grit sizes: 16 and 3μm. As-polished and abraded surfaces were characterized by means of EPMA, XPS, XRD, and hardness test.
Oxygen in the mirror-polished surface was uniformly distributed at the lowest level. Comparatively, abrading with SiC papers increased the surface oxygen amount and hardness.
Owing to its excellent abrasivity, the coarse grit efficiently scratched the surface and hindered the regenerated oxide film from growing thick, but allowed only the metal-oxide interfacial gradient zone to extend. But, the fine grit merely rubbed the surface and allowed both the oxide film and interfacial zone to extend. Further, the surface appeared to be lightly yellow-colored, suggesting that the oxide film was thicker, probably within 10 nm, than the nominal one.
When compared with the bulk, the interfacial zone was rich in oxygen and therefore subjected to high coherency strain, which was introduced to relieve the great lattice mismatch between the outer and inner layers of titanium substrate. Effects of solute oxygen hardening and strain hardening were speculated to be responsible for the surface hardening of both SiC-abraded surfaces. In conclusion, abrading with a coarse grit led to accumulation of a high, non-uniform strain in the titanium substrate, thereby hardening the

surface further.

Key words:
Titanium, Abrading, Oxygen

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