

Author's Accepted Manuscript

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PII: S0921-5093(17)30377-5
DOI: <http://dx.doi.org/10.1016/j.msea.2017.03.070>
Reference: MSA34853

To appear in: *Materials Science & Engineering A*

Received date: 20 December 2016
Revised date: 17 March 2017
Accepted date: 18 March 2017

Cite this article as: Arash Fattah-alhosseini, Mohsen K. Keshavarz, Yousef Mazaheri, Ali Reza Ansari and Mohsen Karimi, Strengthening mechanisms of nano-grained commercial pure titanium processed by accumulative roll bonding *Materials Science & Engineering A* <http://dx.doi.org/10.1016/j.msea.2017.03.070>

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Strengthening mechanisms of nano-grained commercial pure titanium processed by accumulative roll bonding

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Abstract

Grain-refining process in commercial pure titanium was performed by room-temperature accumulative roll bonding. The study on the microstructural evaluations showed a reduction in grain size from about 45 μm in the untreated (annealed) sample to about 90 nm after six cycles of accumulative roll bonding, a reduction factor of about 500 times. The yield strength of the nano-grained commercially pure titanium after the sixth cycle, 799 MPa, was about three times higher than that of the as-received sample, 284 MPa. Different strengthening mechanisms during the accumulative roll bonding processing of the commercially pure Ti were assessed, and the contribution of each mechanism to the yield strength improvement was quantitatively calculated. The results showed that the calculated yield strength (834 MPa) for a six-cycle processed sample is close to the measured value (799 MPa).

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