Prabhat Kumar Rai et al., J Mat. Sci. 2017, 5:6
DOI: 10.4172/2321-6212-C1-009

Corrosion and wear behavior of harmonic structured SUS304L austenitic stainless steel

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Harmonic structured materials consist of a bimodal structure with a periodic or harmonic distribution of fine and coarse grains allowing optimum combination of high strength and ductility to be attained. Harmonic structured materials have potential in variety of applications, where high wear and corrosion resistance are required. Therefore, effect of harmonically distributed fine and coarse grains on the corrosion and wear behavior of a SUS304L austenitic stainless steel was studied and compared with a non-harmonic structured SUS304L and a conventional 304 stainless steel. The corrosion study was performed using linear, potentiodynamic and cyclic polarization techniques as well as salt fog exposure test for 30 days in 3.5% NaCl solution. Improved pitting corrosion resistance was found in case of the harmonic structured steel as compared to that of the non-harmonic and the conventional 304 stainless steel. Harmonically distributed fine grained structure, less porosity and higher fraction of passive α-FeOOH are attributed to the improvement in corrosion resistance of the harmonic structured steel. The wear study was performed using fretting wear tests at varying loads under ball-on-flat contact configuration. Coefficient of friction and wear volume were found to be minimum at intermediate normal load of 5 N, whereas maximum at 10 N in case of the harmonic stainless steel compared to other two steels. Harmonically distributed fine grained structure attributes to the higher wear rate of the harmonic structured steel because of hard and soft interaction of the ball with the harmonically distributed fine and coarse grains.

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Biography

Prabhat Kumar Rai is currently pursuing his PhD from Indian Institute of Technology Kanpur and has completed his M.Tech from Indian Institute of Technology, Banaras Hindu University, Varanasi, India. He has published three papers in reputed journals.

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