# Fatigue Properties of Notched Austenitic Stainless Steel with Harmonic Structure

Shoichi Kikuchi,[a] Yoshiki Ishimura,[b] Keisuke Fujita,[c] Yoshikazu Nakai,[d] Mie Ota Kawabata,[e] Hiroshi Fujiwara,[f] Kei Ameyama,[g]

[a]*Department of Mechanical Engineering, Shizuoka University. E-mail: kikuchi.shoichi@shizuoka.ac.jp*
[b]*Graduate School of Integrated Science and Technology, Shizuoka University. E-mail: ishimura.yoshiki.17@shizuoka.ac.jp*
[c]*Graduate School of Science and Technology, Shizuoka University. E-mail: fujita.keisuke.15@shizuoka.ac.jp*
[d]*Department of Mechanical Engineering, Kobe University. E-mail: nakai.yoshikazu.p72@kyoto-u.ac.jp*
[e]*Department of Mechanical Engineering, Ritsumeikan University. E-mail: mie-ota@fc.ritsumei.ac.jp*
[f]*Department of Mechanical Engineering, Ritsumeikan University. E-mail: fht25395@fc.ritsumei.ac.jp*
[g]*Department of Mechanical Engineering, Ritsumeikan University. E-mail: ameyama@se.ritsumei.ac.jp*

Austenitic stainless steel (JIS-SUS304L) with a bimodal harmonic structure, which is defined as a coarse-grained structure surrounded by a network structure of fine grains, was fabricated using powder metallurgy to improve both the strength and ductility. The present authors have examined the fatigue properties of harmonic structured materials to achieve sufficient performance for practical applications in the engineering fields.[1-3] Axial fatigue tests were conducted for smooth and notched specimens (Fig.1(a)) at stress ratio of 0.1 at room temperature in a laboratory atmosphere. The fatigue limits of the notched specimens with a homogeneous microstructure were lower than those of the smooth one (Fig.1(b)). In contrast, the fatigue limit of the notched harmonic structured specimen showed almost the same as the smooth one (Fig.1(c)). The fracture surfaces and specimen surfaces were observed using scanning electron microscopy (SEM) to elucidate the mechanism of fatigue fracture in SUS304L with harmonic structure. The fatigue crack was initiated from the coarse-grained structure in the smooth specimen with harmonic structure, whereas the fatigue crack was initiated from the fine-grained structure, which shows high resistance of fatigue crack initiation, in the notched specimen with harmonic structure due to the stress partitioning. Thus, a notch effect disappeared by the harmonic structure design.

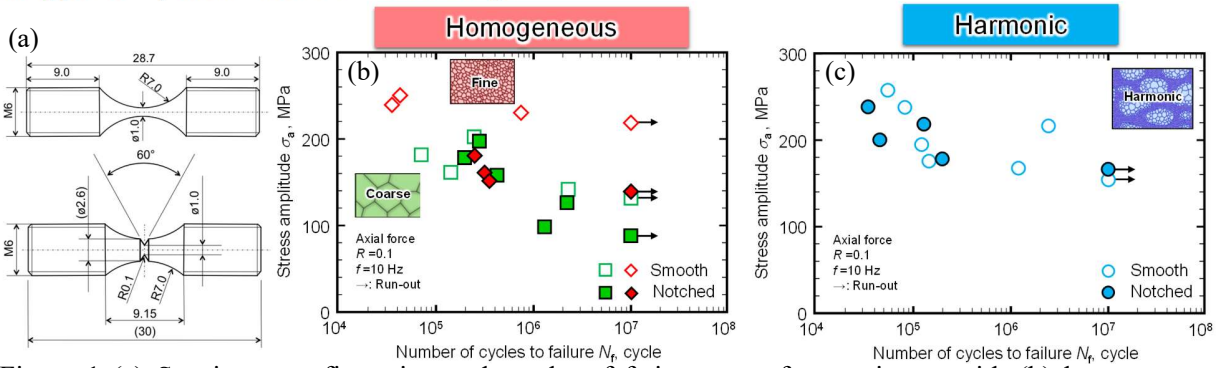


Figure 1 (a) Specimen configuration and results of fatigue tests for specimens with (b) homogeneous microstructure and (c) harmonic structure.

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2) S. Kikuchi, Y. Nukui, Y. Nakatsuka, Y. Nakai, M. Nakatani, M.O. Kawabata, K. Ameyama, *Int. J. Fatigue* **2019**, *127* 222.
3) H. Zhou, Z. Liu, S. Kikuchi, K. Shibanuma, *Mater. Des.* **2023**, *226* 111657.