講演番号 296

文献番号 20225296

Plastic Flow Joining and Strength Evaluation of Steel and Aluminum Alloys

Kaoru Mannami [1)] Yuto Ando [1)] Souichiro Nishino [1)] Ryo Tominaga [2)] Naonori Ishii [2)]

1) Ibaraki University, Graduate School of Science and Engineering
4-12-1 Nakanarusawa, Hitachi, Ibaraki, 316-8511, Japan (E-mail: souichiro.nishino.sn@vc.ibaraki.ac.jp)
2) Aoyama Seisakusho Ibaraki Plant, Co. , Ltd.
2-1-1 Tsudahigashi, Hitachinaka, Ibaraki, 312-0036, Japan

KEY WORDS:**Materials, Aluminum alloy, Iron and steel materials, Joining,** Plastic flow joining, Work hardening [D3]

Plastic flow joining of carbon steel and aluminum alloy was conducted, and joint strength was evaluated by fracture analysis and visualization of material flow to improve joint strength. The pushing load for maximum joint strength is 25kN, and the maximum joint strength was 6.4kN. Filling increased with increasing pushing load. The ring material reached the top of the groove and filled the most when pushed in with a load of 25kN. A prediction equation for joint strength was proposed based on fracture analysis. The predicted joint strength agreed well with the measured values. The flow of material was visualized by two-dimensional mapping of the hardness distribution near the joint. The material is filled into the groove by sliding deformation in the 45-degree direction. Based on the visualized material flow, a method was devised to enhance the filling of the lower groove and improve the joint strength by modifying the groove and jig geometry. However, the joint strength did not increase under the present conditions.

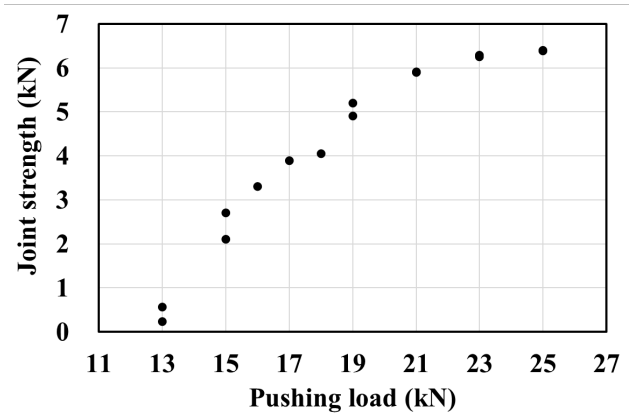

Fig.1 Relationship between pushing load and joint strength

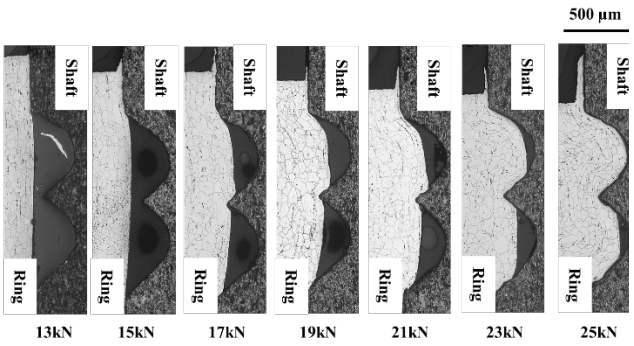

Fig.2 Filling of ring material into shaft groove

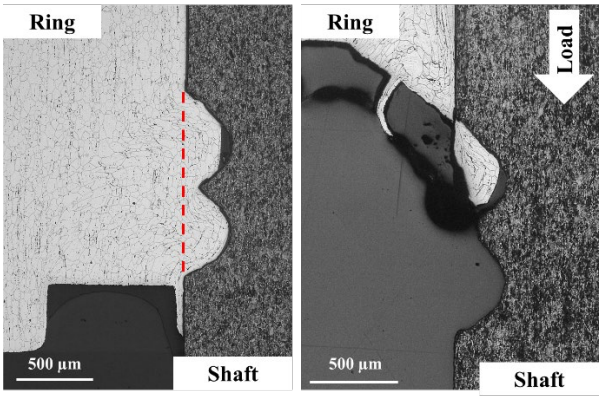

Fig.3 Shear fracture on joint area

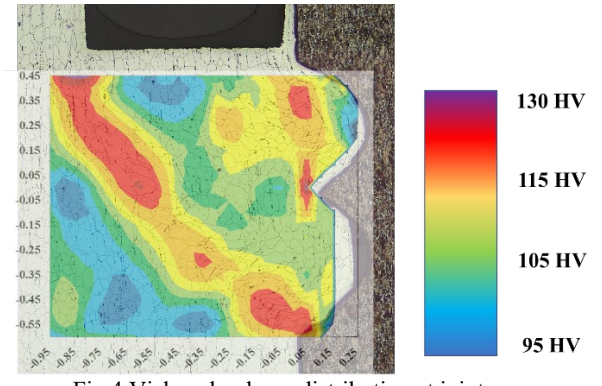

Fig.4 Vickers hardness distribution at joint area