

OP 010

Hardness Prediction of the Heat-Affected Zone in Multilayer Welded Austenitic Stainless Steel Based on Dislocation Density Change Behavior

Lina Yu, Kazutoshi Nishimoto, Hiroyuki Hirata, Kazuyoshi Saida
Osaka University, Suita, Japan

The effects of strain hardening and recovery/recrystallization on the hardness of the heat-affected zone (HAZ) in multilayer welded austenitic stainless steel SUS316 were investigated in this study. The results revealed that strain hardening due to welding strain and softening due to recovery/recrystallization were the dominant factors affecting the hardness change in the HAZ during multilayer welding process. Furthermore, the relationship between the strain and dislocation density and that between the recovery/recrystallization and dislocation density were quantitatively investigated using positron annihilation lifetime spectroscopy. Based on these results, a new hardness prediction method based on the change in dislocation density in the HAZ during multilayer welding was proposed. The hardness values in the HAZ after the multilayer welding were predicted based on the simulated strain and thermal history, and the calculated hardness values agreed well with the measured results. This indicates that the newly proposed hardness prediction method based on the dislocation density change behavior in the HAZ during multilayer welding is valuable and effective for selecting the appropriate welding conditions before actual welding.