

 MLF Experimental Report	提出日 Date of Report 26/04/2013
課題番号 Project No. 2012B0168 実験課題名 Title of experiment Residual stress mapping on ultrasonic shot peened weld joint before and after thermal loading 実験責任者名 Name of principal investigator Koichi Akita 所属 Affiliation JAEA	装置責任者 Name of responsible person Kazuya Aizawa 装置名 Name of Instrument/(BL No.) TAKUMI (BL19) 実施日 Date of Experiment 25-29/01/2013

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
 Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

A dissimilar welded joint was prepared. The size of the joint was 100 x 100 x 10 mm³ as shown in Fig. 1. The materials of the base plates were stainless steel SUS316L and nickel alloy NCF600, and the weld metal was a nickel alloy YNiCr-3. The sample was treated by the ultrasonic shot peening (USP) after welding for introducing compressive residual stress in the surface layer.

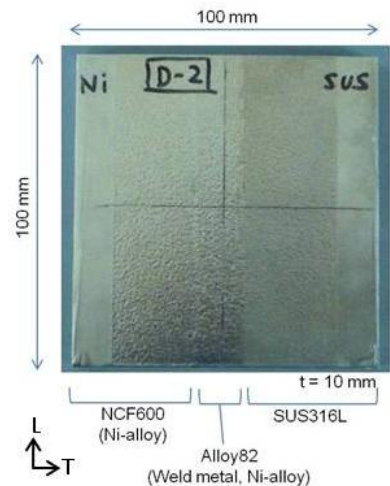


Fig. 1 Dissimilar welded joint.

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。)

Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

The sample was heated from RT up to 593 K step by step using a jacket type heater that we developed, and strain measurements were performed using TAKUMI at the elevated temperatures. The experimental setup is shown in Fig. 2. The heating was repeated two cycles as shown in Fig. 3. The distributions of residual strain were measured by neutron diffraction at each temperature. The gage volume was 2 x 2 x 2 mm³. Directions of the measured strains were L and N. Strain distributions were measured at the mid-thickness of the sample. The data acquisition time for diffraction measurement was 15 min.

2. 実験方法及び結果(つづき) Experimental method and results (continued)



Fig. 2 Setup for experiment at TAKUMI.

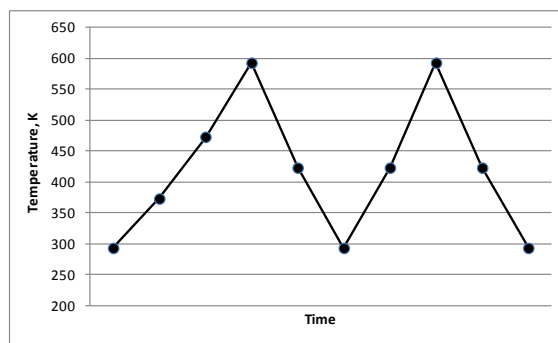
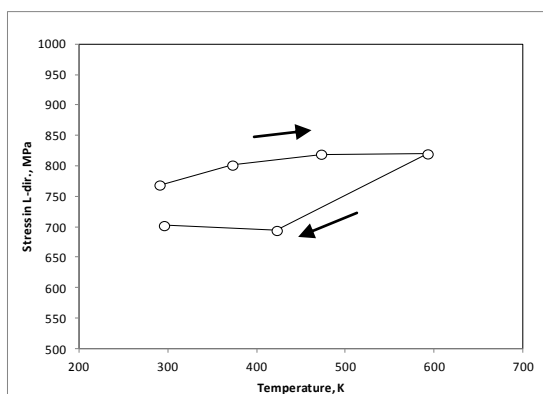
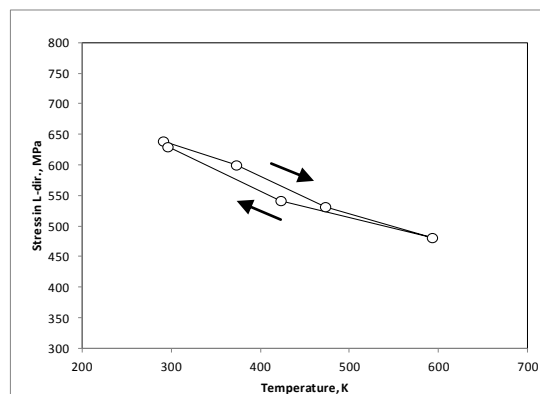


Fig. 3 Heating sequence. Plot marks in the figure indicate the strain measured temperatures.

Residual stresses in the L-direction were calculated by the sin square psi method. Examples of the obtained results were shown in Fig. 4. Fig. 4 (a) and (b) show the residual stress behaviors at the weld interfaces of the NCF600 side and SUS316L side, respectively.



(a) NCF600 (2 mm from weld centre).



(b) SUS316L plate (2 mm from weld centre).

Fig. 4 Examples of changes of the residual stress during the first heating cycle.

The hysteresis loops of the residual stress for both figures were quite different. In the near future, the results will be compared with analyzed results, and the mechanisms of the stress relaxation will be discussed.