Measurement of strain distribution on sheet specimen in tension test validating transition of strain distribution predicted by FEM

Masayoshi Akiyama*, Ryo Morimoto†

* Research Institute for Applied Science (RIAS),
49 Tanaka-Ooi-cho, Sakyo-ku, Kyoto, 606-8202, Japan
e-mail: makiyama@rias.or.jp, web page: http://www.rias.or.jp/Index.php

†2-20-9, Tomatsucho, Amagasaki-shi, Hyogo, 661-0003, Japan
e-mail: rmorimoto0@gmail.com

ABSTRACT

Tension test is one of the most popular tests to obtain a stress-strain curve of a material and precise stress-strain curve ensures the precision of the result of numerical analysis. The stress is calculated by dividing the force by the cross sectional area of the specimen and strain is calculated by measuring the change in the distance between two gauge points. This is based on an assumption such that the distributions of stress and strain are uniform on the centre plane and between the gauge points. However the results of FEA to showed that stress and strain do not necessarily distribute uniformly in the specimen [1] and the point where the largest strain appears moves from the shoulder to the centre according to the progress of tension test [2].

In the present research work the authors tried to measure the non-uniformity of strain on the specimen throughout tension test to validate the results of FEA. Flat specimen of JIS5 was used to investigate the transition process of strain distribution. The material was pure iron. A cast ingot was elongated by hot forging to make a round bar which is 4 times as long as the ingot. The bar was subjected to thermal treatment to homogenize the grain size before flat specimens were sectionded from the bar. Strain gauges were placed on the specimen to monitor the transition of largest strain. An extensometer was also placed to measure the average strain between the two gauge points.

Result of FEA analysis predicted that the largest value of strain is observable at the shoulder portion at the initial stage of yielding. The position of largest strain moved to an intermediate portion when the average strain increased and finally moved to the centre portion. The result validated the predicted result by FEA.

REFERENCES

[1] R. Morimoto and M. Akiyama, Propagation Mechanism of Non-uniform Distribution of Stress and Strain in Tension Test, COMPLAS-XII, 631 (2013).

[2] R. Morimoto and M. Akiyama, Proposal of New Specimen Geometry for Tension Test Restraining Non-Uniform Deformation, COMPLAS-XIII, 968 (2015).