Proposal of New Specimen Geometry for Tension Test Restraining Non-uniform Deformation

R. Morimoto*, M. Akiyama†

* Department of Mechanical and System Engineering, Kyoto Institute of Technology,
Gosho-Kaido-cho, Matsugasaki, Sakyo-ku, Kyoto, 606-8585, Japan
e-mail: m3623053@edu.kit.ac.jp, web page: http://www.mesh.kit.ac.jp

†Department of Mechanical and System Engineering, Kyoto Institute of Technology,
Gosho-Kaido-cho, Matsugasaki, Sakyo-ku, Kyoto, 606-8585, Japan
e-mail: makiyama@ kit.ac.jp, web page: http://www.mesh.kit.ac.jp

ABSTRACT

Tension test is often carried out to obtain the mechanical properties of materials, and the geometry of specimen and the methodology have been standardized by JIS or ISO and so on. Although there are varieties of specimen geometry, little has been investigated on its influence on the precision of measured stress and strain. In COMPLAS 2013 the authors presented the result of investigation using standard specimens on the mechanism through which non-uniformity distribution of stress and strain arises and proposed a measurement of strain that ensures precision of measured value[1]. In the present paper attention is focused on the suppression of non-uniformity of stress and strain using above describing mechanism. Thin sheet specimen was used for the present purpose. There is a non-uniform distribution of stress and strain and the position of peak stress shifts according to the progress of tension test from the shoulder to the intermediate portion and then to the centre. Most influential geometrical parameter is the length parallel portion, and a specimen with a half-length of parallel portion well suppresses the non-uniformity of distribution of stress and strain over the parallel portion. Elastic-plastic analysis was carried out by using a code "ELFEN". The result of validation test showed that short specimen well suppresses occurrence of intermediate rupture in between the end and the centre of specimen. According to the standard the tension test must be repeated when the intermediate rupture occurs but for the short specimen no intermediate rupture disappeared. Adoption of short parallel length completely suppresses the occurrence of intermediate rupture and there is no need of repetition of tension test. It is, therefore, an informative and valuable method from the engineering view point. In addition it was clarified that there is a close correlation between potion of peak stress in the specimen and the portion of rupture point. This conclusion applies to both brittle and ductile materials.

REFERENCES

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