Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2023 **Issue:** 11 **Volume:** 127

Published: 01.11.2023 **http://T-Science.org**

Issue Article

Denis Chemezov
Vladimir Industrial College
M.Sc.Eng., Honorary Worker of the Education Field of the Russian Federation, Academician of International Academy of Theoretical and Applied Sciences, Lecturer, Russian Federation
https://orcid.org/0000-0002-2747-552X
vic-science@yandex.ru

Agannes Arzikyan
Vladimir Industrial College
Student, Russian Federation

Grigoriy Lushin
Vladimir Industrial College
Student, Russian Federation

Alyona Kozlova
Vladimir Industrial College
Student, Russian Federation

Ivan Proshin
Vladimir Industrial College
Student, Russian Federation

Maksim Eremtsov
Vladimir Industrial College
Student, Russian Federation

Talabsho Kamilov
Vladimir Industrial College
Student, Russian Federation

THE DEGREE OF MECHANICAL STRESS OF A METAL SPECIMEN UNDER TENSILE TESTING CONDITIONS

Abstract: *The results of local stress of cylindrical specimens during the tensile test were demonstrated in the article. It is noted that, depending on the configuration of the loaded surface, the stress value of material can increase or decrease linearly or cyclically non-linearly in different sections of the specimen.*

Key words: *specimen, tensile, von Mises stress, length.*

Language: *English*

Citation: Chemezov, D., et al. (2023). The degree of mechanical stress of a metal specimen under tensile testing conditions. *ISJ Theoretical & Applied Science, 11 (127),* 1-3.

Soi: http://s-o-i.org/1.1/TAS-11-127-1 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2023.11.127.1

Scopus ASCC: *2206.*

Introduction

The process of tensile testing of metal cylindrical specimens has been studied in a number of scientific papers [2-10]. In accordance with ISO 6892 [1], special specimens are prepared and tested for their tensile strength on a tensile testing machine. The

essence of the test is to determine the magnitude of the load leading to partial destruction of the specimen. Thus, the maximum tensile stress of material will be obtained. The loaded state of the specimen is tracked according to the dependence of the tensile test diagram. This diagram describes the stress state of material under tension in general, but the nature of the deformation (stress) of the specimen elements does not give. This gap can be filled by computer calculation of the stretching process of the specimen model. The results obtained will complement the general picture of the stress state of the specimen during stretching.

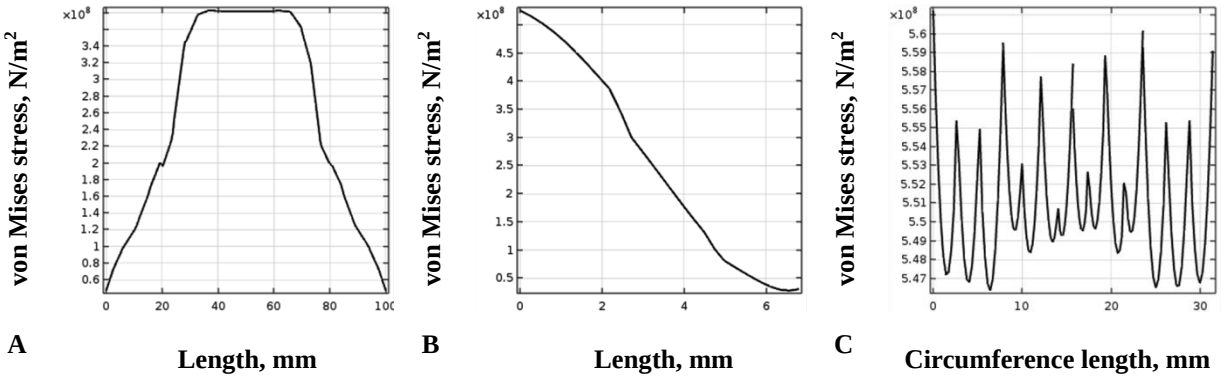
Materials and methods

A three-dimensional solid-state model of the cylindrical specimen was subjected to a tensile test. The testing was implemented in the Comsol Multiphysics computer program. The properties of steel were given to the specimen (Young's modulus and Poisson's ratio were assumed to be 210 GPa and 0.3, respectively). The initial estimated length and diameter of the specimen model were assumed to be 55 and 10 mm, respectively. A force of 30 kN was applied to the specimen model. The degree of stress of the specimen after the test was determined along the axial line, on the fillet and on the cylindrical surface.

Results and discussion

The results of the computer calculation of stress of the specimen material subjected to stretching are presented in the Fig. 1.

A mirror reflection of the stressed state of material is observed along the entire length of the specimen. This is due to the symmetrical configuration of the specimen. The maximum von Mises stress is observed at the estimated length of the specimen. At this length, the destruction of the specimen material occurs after exceeding the tensile strength. From the largest to the smallest cross sections of the specimen, the von Mises stress varies by almost 10 times. The difference in the maximum values of the von Mises stress on the axial line and the outer cylindrical surface of the specimen is observed by 1.5 times. In this case, the surface layers of the specimen cylinder are subjected to stress cyclically (values vary in ascending and descending functions). These changes do not lead to a significant jump in the stress values of the specimen material. The fillet is a smooth radius connecting two cylindrical surfaces with different cross sections. The fillet reduces the value of stress in a large range. On the section of the fillet of 6 mm, changing the von Mises stress occurs 10 times. This proves the effectiveness of performing this element to increase the strength of the specimen during tensile deformation.



A **B** **C**

Figure 1 – The von Mises stress values: A – on the total length of the axial line of the specimen; B – on the length of the fillet of the specimen; C – on the circumference length of the specimen.

Conclusion

Thus, the maximum stress of material is observed at a distance of half the estimated length of the specimen subjected to stretching. According to the highest values of the von Mises stress determined along the axial line, it is possible to make a prediction about the possible destruction of the specimen at the marked distance. The smooth radius on the specimen reduces the local stresses of material up to 10 times over a short length. The cylindrical surface is subjected to stress cyclically, but significant stress drops are not observed.

References:

1. (1998). *ISO 6892. Metallic Materials – Tensile tests at Ambient Temperatures*.
2. Davis, J. R. (2004). *Tensile Testing*. ASM International.
3. Andrade, T. L., et al. (2017). Tensile Test: Comparison Experimental, Analytical and Numerical Methods. *International Journal of Advanced Engineering Research and Science*, vol. 4, no. 11, 87-90.
4. Loveday, M. S., Gray, T., & Aegerter, J. (2004). *Tensile Testing of Metallic Materials: A Review*. NPL Management Ltd, p. 171.
5. Hashentuya, M. (2016). *Experimental study of tensile testing of metallic materials in engineering mechanics.* Proceedings of the 2016 International Forum on Mechanical, Control and Automation (IFMCA 2016), 819-822.
6. Riaz, M., & Atiqah, N. (2016). A study on the tensile test properties of medium carbon steel specimens under specific manufacturing conditions. *Journal of Mechanical Engineering and Technology*, Vol. 8, No. 1, 1-12.
7. Biju, A. T., et al. (2020). Tensile and Hardness Tests on Steel Specimen. *International Journal of Innovative Technology and Exploring Engineering*, 9(6), 1607-1610.
8. Kundan, K., et al. (2014). Use of Miniature Tensile Specimen for Measurement of Mechanical Properties. *Procedia Engineering*, 899-909.
9. Kato, A. (2015). Measurement of Surface Strain Distribution and Stress-Strain Relation of Steel in Tensile Test. *Journal of Material Testing Research Association of Japan*, Vol. 60, No. 1, 57-64.
10. Rund, M., Procházka, R., Konopík, P., Džugan, J., & Folgar, H. (2015). Investigation of Sample-size Influence on Tensile Test Results at Different Strain Rates. *Procedia Engineering*, 114, 410-415.