

CUT PROTECTIVE MATERIALS FROM THE POINT OF VIEW OF WORKING ENVIRONMENT

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Introduction

Cut resistance is defined as the ability of material to resist a blade, which may be determined by means of a variety and evaluation methods, depending on the intended use of the material and the applied cutting factor. Some of the earliest studies on cutting were conducted in the 1990s involving textile and polymeric materials. Cut resistance tests given in international standards are mostly used for proving that products meet specific normative requirements, but they fail to account for the complexity of the physics of cutting and fall short in terms of evaluating advanced materials arising with the fast-paced development of materials technologies [1-2]. **Moreover, the available literature does not contain many research on the cut resistance properties of e.g. three-dimensional hybrid textile materials taking into account the real conditions of use.** As a result, it is need to develop more objective methods for evaluating cut resistance properties, therefore preliminary assumptions for the new method has been described.

Materials and methods

Cut resistance of knitted fabrics (S.I. ZGODA, Poland) were assessed using two standard methods (EN 388 and EN ISO 13997). The test methods described in those standards differ in type of blade, EN 388:2016+A1:2018 employs a round cutting blade applying constant cutting force, while EN ISO 13997:1999 uses a straight blade applying variable cutting force. **First cut resistance test method (using circular blade)** was determined on the basis of index 'I', which is an abstract number calculated as an arithmetic mean of five 'i' indexes calculated on the basis of the number of blade rotations causing the cutting of the test sample and control specimen. The blade loading amounts to 5 ± 0.05 N, whose sharpness is checked before each test performed on the material sample with a control specimen. **Second cut resistance test method (using longitudinal blade)** was determined on the basis of various values of force exerted on the blade. Data obtained from tests with at least three different forces (for each force value five cuts of a test sample are carried out) are used for plotting a graph of the correlation between the cutting distance and values of forces applied.

Results and conclusions

It is important to take into consideration other blade angles as well, as may occur in the working environment because the standard method takes into account only blade angle of 90°. Gloves made of high-strength yarns effectively protect workers during operations involving contact with sharp tools as well as materials being processed, such as metal sheets or glass panels.

The highest cut resistance according to EN 388:2016+A1:2018 was obtained by knitting polyester and glass fibre (DR-1.1) while cut resistance according to EN ISO 13997:1999 was relatively low. On this basis test results could show a high resistance to cutting, while the material does not provide high cut protection. The case of that sample confirms in particular that the method which is using circular blade is not reliable for tests performed on materials with very high resistance to cutting. **Rapid blunting of the cutting edges of blades and consequently the impossibility of providing reproducible conditions for the experiment poses a key problem during cut resistant evaluation.**

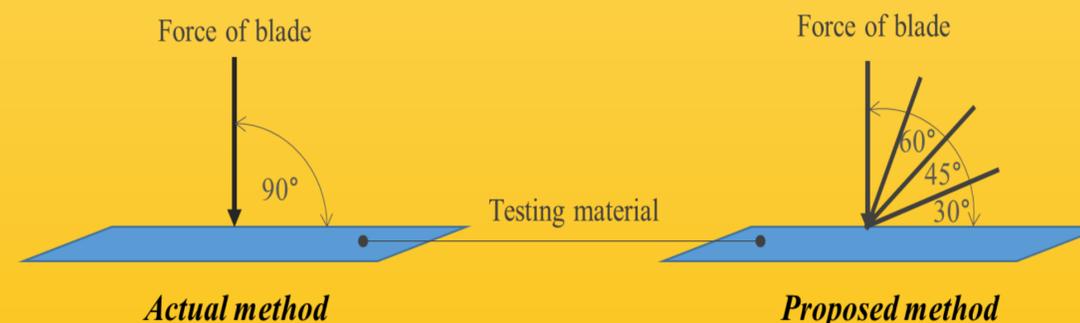


Fig. 1. Assumptions to determination of cut resistance using variable blade angle

This paper presents preliminary assumptions to enable the determination of cut resistance using variable blade angle as it is important from the point of view of applications in the working environment to take it into consideration.

Literature:

[1] El Mogahzy Y. E. (2009). Engineering textiles. Woodhead Publishing, ISBN: 9781845690489 ; [2] Irzmańska E., Stefko A. (2012). Comparative evaluation of test methods for cut resistance of protective gloves according to polish standards, Fibres and Textiles in Eastern Europe, vol. 94