AUTEX 2021

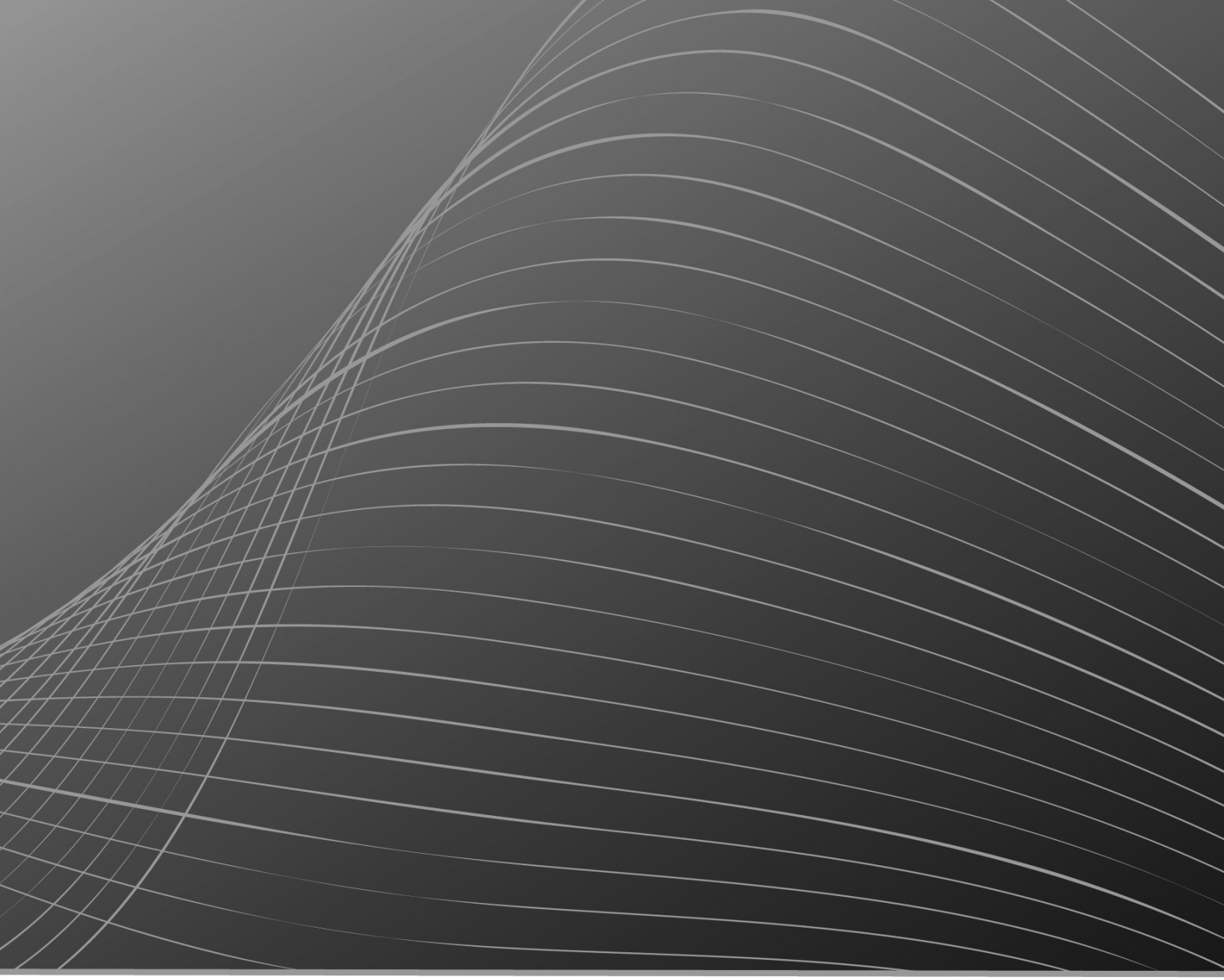
20th World Textile Conference

Unfolding the Future

5 - 9 September 2021 | Guimarães, Portugal **& Online**

Book of Abstracts

Edited by Sciencentris



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BOOK OF ABSTRACTS

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FOREWORD

Unfolding the Future is the moto of the 20th International AUTEX Conference, held on 5th to 9th September 2021.

Recognized as a reference among the textile scientific community, the AUTEX conferences gather every year a large number of researchers that share their ideas and achievements in various research and educational projects.

At the beginning of this new decade, very important challenges are being faced concerning the sustainability of our planet, that directly impact the textile and fashion business. Also, the most recent global health threats enhance the societal relevance of textiles and the major contribute to protect people and overcome this menace to Humanity.

The Autex2021 Conference was the right place to unveil and show the novel approaches, concerning materials, technologies and business models, that are being thought and developed.

Through the great number of communications presented on 20th AUTEX, the state of the art of multiple themes related to textiles, from materials to technology, from design to merchandising, from education to products, from sustainability to circular economy, was actually revealed and unfold the future of this industrial sector and, as fibrous materials are more and more omnipresent, certainly **Unfold our Future Way of Life.**

Guimarães, 5th September 2021

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Conference Chairman

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ABSTRACT
This research considers a possibility to enhance the mechanical and spectrophotometric properties of a military camouflage cotton textile by applying a nano silver/poly(vinyl butyral), PVB, impregnation. Silver is known for its unique optical, electrical, thermal properties and antimicrobial activity[1]. PVB is chosen as a good impregnating matrix, being a thermoplastic elastomer with good adhesion behavior, resistant to wetting [2]. Impregnated fabric samples were examined regarding spectrophotometric properties and mechanical abrasion resistance. To achieve low visibility, besides being painted to match the colors of the environment, a surface must scatter light, so it should have a matte, low gloss coating [3, 4]. Diffuse reflectance and gloss are related, and from a spectral point of view, scattering properties are relevant for surface appearance [5]. Certain nanostructures may alter this feature.

MATERIALS AND METHODS
The following raw materials were used: PVB powder Mowital B30H (Kuraray GmbH); nano silver (US Research) 5-20 nm; ethanol 96% (ZorkaŠabac) and military cotton fabric. Impregnation was done: PVB was dissolved in ethanol in which nano-Ag particles were ultrasonically dispersed; this solution was applied evenly onto textile and dried until ethanol evaporated. In the same way the sample was impregnated with PVB without nano-Ag. The round pieces of fabric were cut out for spectrophotometric, colorimetric and for abrasion resistance measurements. Specular gloss was measured on 8 spots on the material using Elcometer 480 model T, at an angle 85°. Diffuse reflectance and color coordinates were determined using Shimadzu UV VIS NIR spectrophotometerUV 3600. Diffuse reflectance was measured in the area of the electromagnetic spectrum from 250-2000 nm. Color coordinates were measured in the visible part of the electromagnetic spectrum (380-780 nm) using the color program package with 10° and D65 observer, in the CIE Measurement Lab space. SDL Atlas device Martindale Abrasion and Pilling tester was used to determine abrasion resistance of the material, in 30000 cycles.

RESULTS AND DISCUSSION
Results for the specular gloss are the following: for the sample coated only with PVB specular gloss was 0.6, and for the sample coated with PVB/nano-Ag it was 0.5. The results are very similar to each other, they both are below the demanded values required by the standard [4], but there is a mild improvement due to the added nano silver: the gloss decreased.
Color coordinatesL*, a* and b* for two green shades are given in Table 1.The main characteristic that can be calculated from these data is the ΔE difference, according to Eq. [1].

$$\Delta E = \sqrt{\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}} \qquad [1]$$

If the ΔE is less than 1, the difference between the two shades is not visible to the observer's eye.Those differences for two shades of interests are also given in Table 1. These results show that the differences could be seen by the observer's eye, but this might be avoided if nano-Ag was included in the original paint formulation.

Table 1.Color coordinates for light green and dark green shade

Material	L^*	a^*	b^*	ΔE
With PVB impregnation for light green shade	46.05	-3.87	15.95	5.5
With Ag impregnation for light green shade	41.02	-5.76	14.73	
With PVB impregnation for dark green shade	35.05	-8.01	12.32	2.0
With Ag impregnation for dark green shade	33.57	-7.47	11.05	

Diffuse reflectance graphs registered for the two chosen camouflage shades, the light and dark green, are presented in Figure 1. Every sample was measured only once. Diffuse reflectance has ±1% measurement uncertainty.

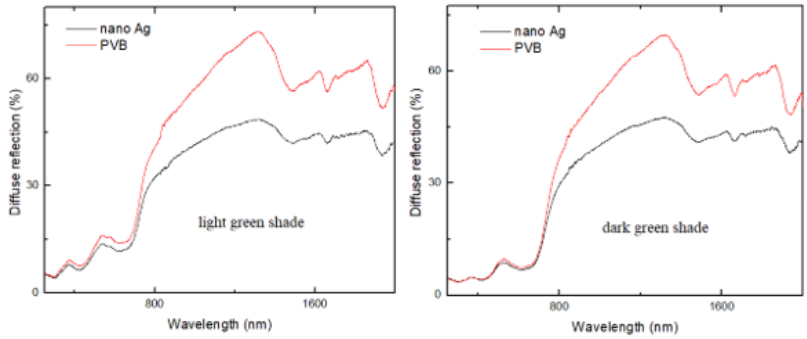

Figure 1.Diffuse reflectance for the light green shade and the dark green shade

As seen from the graphs, nanoreinforcement decreases the values of diffuse reflection for both shades. The overall look of the graphs also shows that this decrease is of the same order for both shades. Abrasion resistance, analyzed by visual inspection, was better for the fabric impregnated with PVB/Ag than for the neat PVB.

CONCLUSION

From the registered diffuse reflection it may be concluded that nano-Ag is enhancing the camouflage behavior of the material in the part of the spectrum for the selected shades. The specular gloss has not changed significantly. Colorimetry results indicate that the difference between the samples is visible to the observer's eye. Mechanical testing has shown that the addition of nano silver has improved the material's resistance to abrasion.

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REFERENCES

[1]Haider, A., Kang, I.-K. Preparation of Silver Nanoparticles and Their Industrial and Biomedical Applications: A Comprehensive Review, Advances in Materials Science and Engineering, vol. 2015, Article ID 165257, 2015.
[2]Carrot, C., Bendaoud, A.,Pillon, C. Polyvinyl Butyral, from: Handbook of Thermoplastics CRC Press, doi/10.1201/b19190-4.
[3]FarrierL. M.(2006).Influence of surface roughness on the specular reflectance of low gloss coatings using bidirectional reflectance measurements, University of Dayton, Ohio
[4]The U.S. Department of Defense specification number for standard MIL-PRF-85285
[5]Åkerlind,C., FagerströmJ., Hallberg T., KariisH.(2015). Evaluation criteria for spectral design of camouflage, Proc. SPIE 9653, Target and Background Signatures.
doi.org/10.1117/12.2194828.