



**UNION OF ENGINEERS AND TEXTILE
TECHNICIANS OF SERBIA**

**V INTERNATIONAL SCIENTIFIC CONFERENCE
CONTEMPORARY TRENDS
AND INNOVATIONS IN
THE TEXTILE INDUSTRY**

**V MEĐUNARODNA NAUČNA KONFERENCIJA
SAVREMENI TRENDovi I
INOVACIJE U TEKSTILNOJ
INDUSTRIJI**

PROCEEDINGS

EDITOR:

Prof. dr SNEŽANA UROŠEVIĆ

**Belgrade, 15-16th September, 2022.
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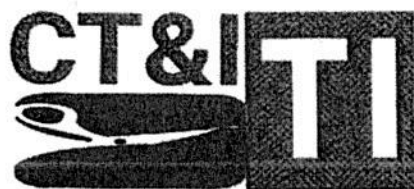
**UNION OF ENGINEERS AND TEXTILE TECHNICIANS
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**“CONTEMPORARY TRENDS AND INNOVATIONS IN THE
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PREFACE

The 5 th International conference "Contemporary Trends and Innovations in the Textile Industry" CT&ITI 2022, is co-organized by the Union of Engineers and Textile Technicians of Serbia, the Union of Engineers and Technicians of Serbia, the Faculty of Technology and Metallurgy in Belgrade, the University of Faculty of Technology, Shtip, North of Macedonia, Society for Robotics of Bosnia i Herzegovina and Balkan Society of Textile Engineering-BASTE of Greece.

The Ministry of Education, Science and Technological Development of the Republic of Serbia recognized the importance of this Conference, and thus, supported it.

The aim of this Conference is to consider current technical, technological, economic, ecological, R&D, legal and other issues related to the textile industry, then the application of contemporary achievements and the introduction of technical and technological innovations in the production process of fiber, textile, clothing and technical textile by applying scientific solutions in order to improve the business and increase the competitive advantages of the textile industry on the domestic and global market.

Leading scientists and experts from the Balkans and other countries, working at faculties, textile colleges and institutes, but also individuals who professionally deal with the issues at hand are taking part in this Conference.

The Conference program involves papers dedicated to the scientific and practical aspects of the following topics: Textile and Textile Technology, Textile Design, Management and Marketing in the Textile Industry and Ecology and Sustainable Development in the Textile Industry. The Conference program includes 48 papers, and a total of 116 participants from 14 countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, India, Latvia, North of Macedonia, Portugal, Romania, Russia, Serbia, Slovenia and Turkey.

Therefore, this Conference is an opportunity for establishing scientific, educational and economic cooperation of our country with other countries. Certain number of papers by domestic authors present the project results dealing with fundamental research and technological development, financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

I would like to thank all those who have made it possible to organize the conference Contemporary Trends and Innovations in the Textile Industry and make it a success. First, I would like to thank the Scientific and Organizing Committee for working hard, spending countless hours and finding the best solutions for numerous organizational aspects of our Conference. Also, I would like to express my gratitude to all sponsors who believed in the importance of this Conference and co-financed it. I also thank all the other institutions that supported the Conference in various ways, because without their support, the Conference could not have been organized. Last but not least, I would like to thank plenary lecturers, all authors and co-authors and guests for their participation in the Conference.

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TABLE OF CONTENTS

PLENARY LECTURES	1
Biljana Pejić, Marija Vukčević, Ana Kalijadis, Mirjana Kostić HEMP FIBERS AGAIN IN SERBIA: OLD FIBERS – NEW APPLICATIONS	3
Emilija Toshikj, Ognen Petrovski, Milena Petrovska, Igor Jordanov ANTIMICROBIAL ACTIVITY OF COTTON YARNS TREATED WITH DIFFERENT CONCENTRATION OF CHITOSAN	13
Davor Đolar, Iva Ćurić TEXTILE WASTEWATER REUSE WITH MEMBRANE SEPARATION PROCESSES	18
Zlatin Zlatev, Liliana Indrie, Julieta Ilieva REPRESENTATION OF TEXTILE DRAPES OF SQUARED SAMPLES FROM DIGITAL IMAGES	26
Dragana Frfulanović COSTUME AT THE PORTRAIT PRESENTATIONS OF NOBLEWOMEN IN THE CHURCH IN DONJA KAMENICA	34
CONFERENCE PAPERS SESSION I	45
Erhan Kenan Çeven, Gizem Karakan Günaydin, Nejla Çeven, Gülşah Karakaya DRAPABILITY PERFORMANCE OF LYOCELL BLENDED DRAPERY FABRICS MADE OF DIFFERENT FIBRE TYPES	47
Dimitrios Chaidas, Tatjana Spahiu, John Kechagias 3D PRINTING ON TEXTILES USING THE FUSED FILAMENT FABRICATION:A KEY STUDY	56
Ruzica Stevkovska-Stojanovska, Maja Jankoska, Goran Demboski PROGRAMMING AND PRODUCTION OF KNITTED FABRIC WOMEN'S BLOUSE ON A COMPUTERIZED KNITTING MACHINE	63
Tadeja Penko, Zoran Stjepanović, Andreja Rudolf DIGITAL FASHION & DIGITAL SKILLS	73



Maja Jankoska COMPUTER AIDED PATTERN MAKING OF LADY'S SWIMSUIT FROM IDEA TO REALIZATION	83
Athanasios Manavis, Prodormos Minaoglou, Lazaros Firtikiadis, Nikolaos Efkolidis, Panagiotis Kyratsis COMPUTATIONAL CUSTOMISED SHOE-SOLE DESIGN: A BRANDING- BASED APPROACH	90
Koviljka A. Asanovic, Mirjana M. Kostic, Tatjana V. Mihailovic, Nadiia Bukhonka, Slavica B. Maletic INVESTIGATION OF THE QUALITY OF FLAX PLAIN SINGLE JERSEY WEFT-KNITTED FABRICS	99
Subrata Das, Keerthana Shanmugaraja DEEP LEARNING NEURAL NETWORKS FOR KNITTED FABRIC DEFECT IDENTIFICATION AND CLASSIFICATION	109
Snežana Stanković, Milada Novaković EFFECT OF YARN TWIST ON THEIR ELASTIC PERFORMANCE	119
Sara Srebrenkoska, Marija Cekerovska DEFECT CHARACTERISTICS USING AUTOMATED FIBER PLASEMENT	126
Nikola Ilanković, Dragan Živanić FUNDAMENTALS OF CONVEYOR BELTS	134
Mokina Anna Y, Ulme Andra MODERN ART TEXTILES IN THE SPATIAL ENVIRONMENT OF THE XX-XXI CENTURIES CONFERENCE PAPERS	144
Sanja Risteski, Vineta Srebrenkoska FASHION IN THE PERIOD OF THE 19TH AND 20TH CENTURY IN THE EASTERN REGION OF THE REPUBLIC OF NORTH MACEDONIA AS AN INSPIRATION FOR MODERN FASHION SOLUTIONS	155
Dragana Frfulanović, Milena Savić, Aleksandra Perić-Nikolić ON THE MARGINS OF THE AVANT-GARDE AND TRADITION-CONSTRUKTIVISM IN SOCIALIST FASHION DESIGN	163
CONFERENCE PAPERS SESSION II	177
Gordana Kokeza, Sonja Josipović, Snežana Urošević RECOVERY AND STRATEGIC DIRECTIONS FOR THE DEVELOPMENT OF THE TEXTILE INDUSTRY IN THE POST-COVID PERIOD	179



Kosana Vićentijević, Snežana Rakić, Nikola Stojanović IDENTIFYING OF POTENTIAL CHALLENGES OF CSR AND SDG IN THE TEXTILE INDUSTRY	193
Adela Medović Baralić, Biljana Popović, Ljiljana Sretković TEXTILE INDUSTRY IN THE LIGHT OF SUSTAINABLE DEVELOPMENT	202
Marina Jovanović, Snežana Urošević, Milovan Vuković CORPORATE SOCIAL RESPONSIBILITY IN THE TEXTILE INDUSTRY	212
Silvana Zhezhova, Sonja Jordeva, Sashka Golomeova Longurova, Vineta Srebrenkoska, Vanga Dimitrijeva Kuzmanoska ANALYSIS OF THE SITUATION WITH TEXTILE WASTE	226
Iva Ćurić, Davor Dolar, Šejla Sarunović DETERMINING THE EFFICIENCY OF TREATED TEXTILE WASTEWATER ON THE COLOR OF THE COTTON KNITTED FABRIC WITH THE DETERMINATION OF ZETA POTENTIAL	235
Damjana Celcar UPCYCLING – REUSE AND REDESIGNING OF DISCARDED CLOTHES	243
Njegoš Dragović, Snežana Urošević, Milovan Vuković INCREASING ENERGY EFFICIENCY OF TEXTILE INDUSTRY	251
Bruno Završnik THE IMPACT OF THE COVID-19 PANDEMIC ON CLOTHES ONLINE SHOPPING	262
Bruno Završnik ADVERTISING FASHION CLOTHES ON SOCIAL MEDIA	271
Snežana Knežević, Stefan Milojević, Marko Milašinović, Aleksandra Mitrović EVALUATION OF FINANCIAL PERFORMANCE OF ENTERPRISES IN THE FASHION INDUSTRY USING NON-STANDARDIZED FINANCIAL METRICS	277
Dragan Dimitrijević, Snežana Urošević, Živoslav Adamović INTEGRAL INFORMATION SYSTEMS IN SMALL AND MEDIUM ENTERPRISES OF TEXTILE AND CLOTHING INDUSTRY	284
Gordana Čolović, Nikola Maksimović, Danijela Paunović, Mina Paunović ANALYSIS OF WORKPLACES IN THE FASHION INDUSTRY BY RULA TOOL	299



Violeta Stefanović, Snežana Urošević, Ivana Mladenović-Ranisavljević, Dragan Igić
IMPACT OF HARMFULNESS OF CHEMICAL SUBSTANCES IN THE
WORK PROCESS IN TEXTILE INDUSTRY ORGANIZATIONS 305

Mina Paunović, Miroljub Nikolić, Gordana Čolović
APPLICATION OF THE LEAN CONCEPT IN THE PROCESS OF MAKING
A TEXTILE PRODUCTS 316

Olga Stojanović, Marija Savić Pojužina, Kristina Savić, Jelica Simeunović
APPLICATION OF HEIJUNKA TECHNIQUE IN THE
GARMENT INDUSTRY 322

CONFERENCE PAPERS
SESSION III 331

Teodora Gvoka, Gojko Vladić, Nemanja Kašiković, Katarina Maričić,
Gordana Bošnjaković
APPLICATION OF CAST CARDBOARD PACKAGING IN THE TEXTILE
INDUSTRY 333

Miloš Vorkapić, Teodora Vićentić, Dušan Nešić, Dragan Tanasković,
Ivana Mladenović
3D PRINTING IN THE COMPONENTS REALIZATION FOR THE
TEXTILE INDUSTRY 340

Aleksandar Zdravković, Ivanka Ristić, Aleksandra Mičić,
Dragana Marković Nikolić, Danijela Stojadinović, Tanja Nikolić, Nebojša Ristić
OPTIMIZATION OF REMOVAL PROCESS OF CATIONIC DYE FROM
WATER USING NATURAL SORBENTS 352

Emilija Toshikj
IMPACT OF INK LIMITING LEVEL FOR PRINTING SUBLIMATION
PAPER ON QUALITY OF SUBLIMATION PRINT 364

Nebojša Ristić, Ivanka Ristić, Suzana Đorđević, Aleksandra Mičić
COLOR CHANGING SMART TEXTILES: PHOTOCHROMIC
AND THERMOCHROMIC MATERIALS 370

Nuno Belino, Carmo Serrano, Maria Pinto, Jesus Rodilla, Margarida Sapata,
M. Conceição Oliveira
DEVELOPMENT OF VEGETABLE DYES FOR NATURAL
DYEING OF WOOL 384

Katarina Maričić, Nemanja Kašiković, Gojko Vladić, Teodora Gvoka
SMART TEXTILES AND PRINTING 396



Olga Stojanović, Marija Savić Pojužina, Kristina Savić, Jelica Simeunović
INFLUENCE OF TEXTURING PROCESS PARAMETERS ON THE DEGREE
OF CRYSTALLINITY AND BIREFRINGENCE PA6.6 TEXTURED YARN 405

Sara Srebrenkoska, Marija Cekerovska
AUTOMATED FIBER PLACEMENT TECHNOLOGY OVERVIEW 411

Ineta Nemeša
ADVANCED FEED SYSTEMS FRO LOCKSTITCH SEWING MACHINES 418

Dušan Nešić, Dragan Tanasković, Miloš Vorkapić
APPLICATION OF CONDUCTIVE MATERIALS ON
TEXTILE SUBSTRATES 425

Author index 431

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V International Conference
„Contemporary trends and innovations in textile industry“
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APPLICATION OF CONDUCTIVE MATERIALS ON TEXTILE SUBSTRATES

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ABSTRACT: *An overview of electronics on textiles and the main characteristics that give it great potential in the application of materials is given. The application of (self-adhesive) conductive textile and (self-adhesive) copper tape on a textile base is given in particular. The characteristics, both good and bad, of both textiles as substrate and conductive strips on textiles are considered, especially during use. The method of cutting conductive strips and transferring them to textiles by means of a special self - adhesive strip as a sacrificial layer is shown. With self-adhesive tapes, they also give the possibility of easy removal of the conductive structure and installation of a new one without damaging the substrate.*

Keywords: *electronic textile, conductive textile, copper tape, filters, microwaves*

PRIMENA PROVODNIH MATERIJALA NA TEKSTILNOJ PODLOZI

APSTRAKT: *Dat je pregled elektronike na tekstilu i glavne karakteristike koje joj daju veliki potencijal u primeni materijala. Posebno je data primena (samolepljivog) provodnog tekstila i (samolepljive) bakarne trake na tekstilnoj podlozi. Razmatrane su karakteristike, dobre i loše, kako tekstila kao podloge tako i provodnih traka na tekstilu, posebno tokom upotrebe. Pokazan je način sečenja provodnih traka i prenošenje na tekstil putem posebne samolepljive trake kao žrtvujućeg (sacrificial) sloja. Kod samolepljivih traka daju i mogućnost lakog skidanja provodne strukture i stavljanja nove bez oštećenja podloge.*

Ključne reči: *elektronika na tekstilu, provodni tekstil, bakarna traka, filtri, mikrotalasi*

1. INTRODUCTION

Electronics in general, and with it microwave technology, are increasingly used on textile surfaces [1-10]. The field developed very quickly and acquired a large number of applications from ordinary life to special medical controls. This substrate also has its

limitations, which are reflected in the variation of up to 10% of the values of parameters such as dielectric constant and thickness [6].

In addition to the substrate, the use of conductive textiles as metallization is very actual [8-13]. It lags behind pure metal in conductivity but also has advantages. The advantage over the pure metal layer is primarily in the flexibility and mechanical resistance coupled with the use of textiles [9-11]. Despite this, the use of self-adhesive metal tapes, especially copper but also aluminum, are very current. The biggest advantage over conductive textiles is conductivity, but also easier bonding, especially copper with soldering.

An important application of self-adhesive conductive textile with conductive adhesive is the creation of a multilayer structure of the conductive layer that increases the conductivity [11] or electrically connects parts of the structure [12,13].

One of the problems is the transfer of the formed conductive structure to a given textile substrate, which is a general issue with other bases as well. Complicated sacrificial layers or etching and cutting on the textile base itself are used, which is often demanding due to a possible defect on the substrate. There is also the problem of large areas, such as clothes, as well as curved surfaces where it is impossible to easily bite or cut.

2. APPLICATION

Grid conductive cloth tape, *Xinst0402/12*, *Shenzhen Xinst Technology Co., Ltd*, total thickness (textile + conductive glue) 120 μm was used for conductive textiles with conductive adhesive. The conductivity of a given textile with a copper-nickel structure and polyester is about 10^5 S/m (copper bulk is $58 \cdot 10^6$ S/m). A photograph of the surface and its photomicrograph is shown in Fig. 1. The disadvantage is the presence of plastic that makes it difficult to common soldering or bonding with silver epoxy paste.

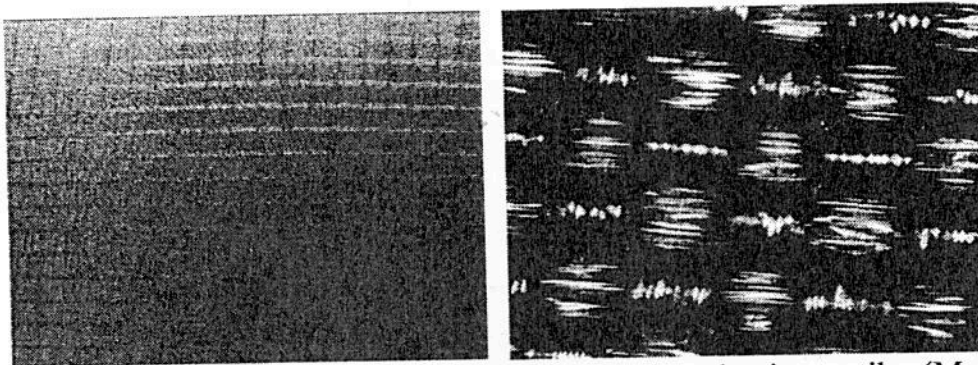


Figure 1: Photography and microscopic photography of conductive textiles (Motic 100x) [12].

The cutting was done by hand with a precision scalper given in [12]. In Fig. 2 are photographs from [12] of a cut structure on copper tape (copper 30 μm + non-conductive glue 30 μm) and of a cut structure on the given conductive textile. There is a tendency to wrinkles the copper tape while the conductive textile has remained flat.

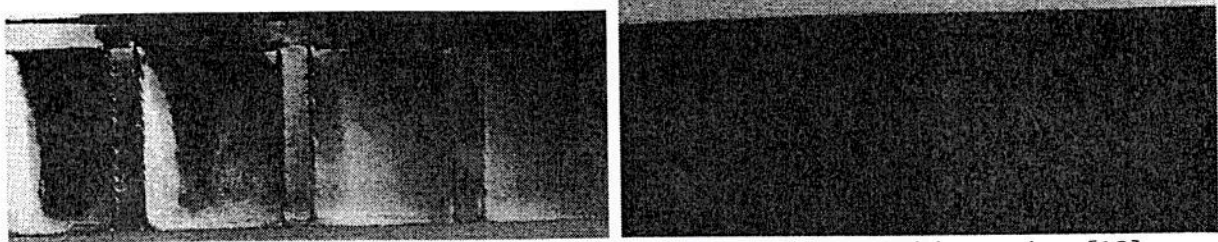
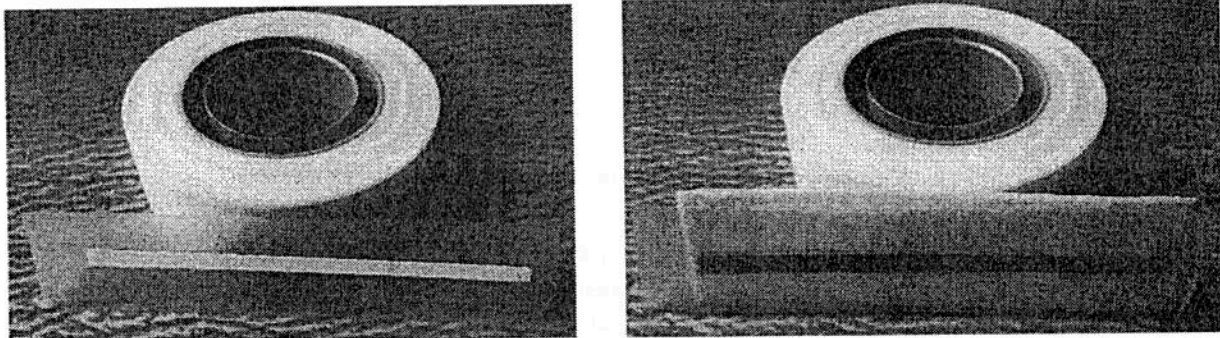


Figure 2: Copper strips and conductive textiles cut with a precision scalper [12]. There is a tendency to wrinkles the copper while the conductive textile has remained flat.

Using a special self-adhesive tape (*Scotch Removable*), as a sacrificial layer, the conductive structure is transferred to the textile. Fig. 3a, 3b and 4 shows the procedures on the example with one strip of the sacrificial layer, where two strips are needed for the whole structure.



a)

b)

Figure 3:

- a) Self-adhesive transparent tape (*Scotch Removable*) is glued to conductive textiles. Only supporting paper carrying conductive textiles and glue can be seen.
- b) The supporting paper was removed and the entire construction was glued to the substrate.

One can see the glued conductive textile, in our case a felt substrate, and the self-adhesive transparent tape glued to it.

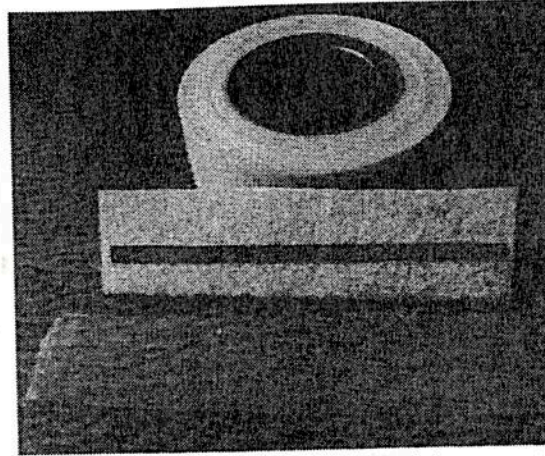


Figure 4: Removed self-adhesive transparent tape as a sacrificial layer and only conductive textile remains on a felt substrate.

In Fig. 5. photos from above and below of the filter with copper strip are given. You can see the use of short-circuited edges using conductive textiles with conductive glue. The use of short-circuiting at the edge is much closer to the definition of short-circuited branches than the usual conductive holes (via). In Fig. 6 is a photograph of the structures with conductive textiles from above using a short circuit at the edge. In Fig. 7 is a photograph of the soldering solution of the SMA connector on conductive textiles. Copper is next to the connector for easier soldering, and the rest of the small part of copper is covered with conductive textiles that are on the rest of the filter. The application of conductive textiles with conductive adhesive can be seen here, similar to that in [11-13].

3. CONCLUSION

Used metallization on the textile is a grid conductive textile with conductive adhesive, total thickness 120 μm , or a guitar copper tape 30 μm , with non-conductive adhesive 30 μm . Textile substrate is a felt substrate. Both metallizations have advantages and disadvantages. The conductive textile remains flat and has the conductive adhesive. The copper tape has a higher conductivity and is better for soldering.

The use of special self-adhesive tape as a sacrificial layer enables the transfer of the formed conductive structure to textile surfaces.

The self-adhesive conductive structure enables the detachment of the conductive layer and the re-formation of a new one without damaging the substrate. It is possible to peel off the conductive layer together with the bond.

ACKNOWLEDGEMENT

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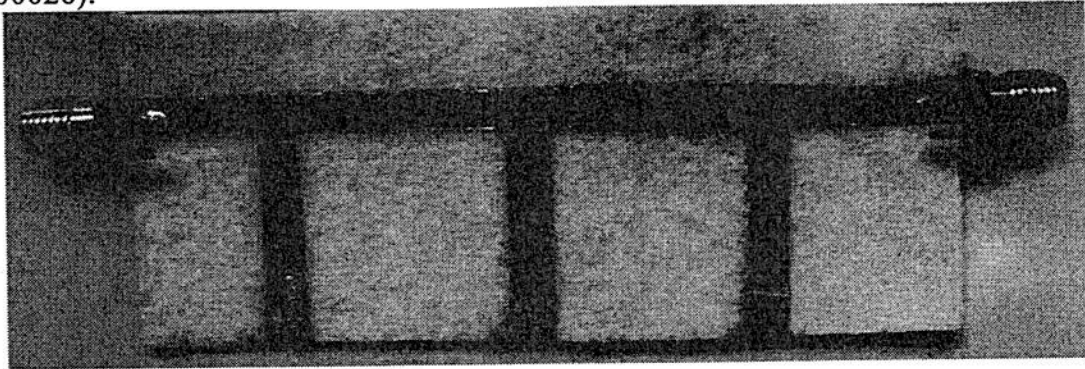


Figure 5: Structure with copper strip from above and below.
You can see the use of short-circuited edges using conductive textiles with conductive glue.
Wrinkled copper surface can be seen.

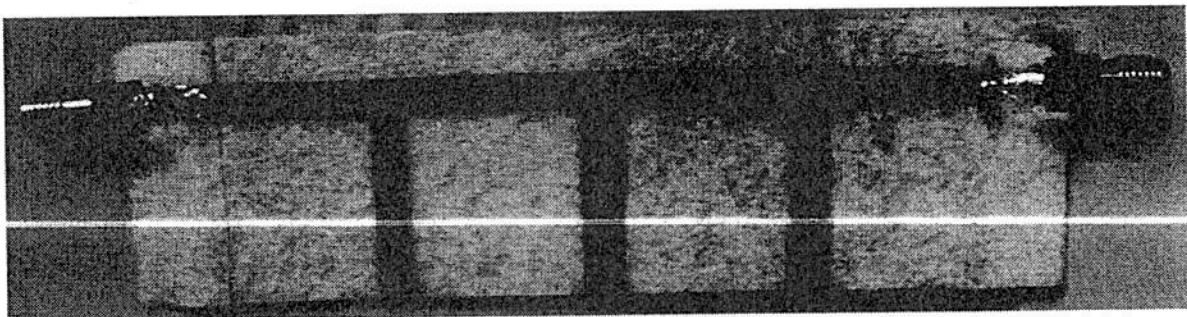


Figure 6: Structure with conductive textiles from above.
One can see the use of shorting on the edge.

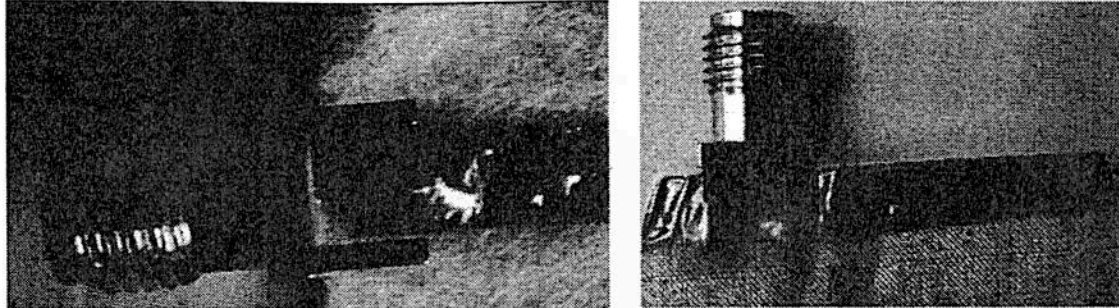


Figure 7: SMA connector contact details from structure in **Figure 6** above and below. For soldering next to the connector is copper, which is partly covered with the conductive textiles.

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