Novel Fabrics with Conductive Fibres

Savvas Vassiliadis*

Christopher Provatidis**

Kleanthis Prekas*

Maria Rangussi*

* TEI PIRAEUS

** NTUA

Permanent trends in the textile technological evolution

- Availability of products
- Higher quality
- Lower prices

Current Conditions

- Product driven procedures
- Open markets – Globalization
- International competition
- Adoption of quality systems worldwide

Consumers criteria:

- In the past:
  - Country of origin
  - Brand name
- Now:
  - Quality assurance systems
  - Supply chains integrity

Textile science and technology

- In the past:
  - Self-standing field
- Now:
  - Dynamically interacting
  - Interdisciplinary development

Roles of clothes

- Traditionally:
  - Protection
  - Aesthetic pleasure
  - Social promotion
- Additionally now:
  - Multifunctionality

Characteristics of the smart textiles

- Intelligent
- Interacting

Electronic + Textiles = e-textiles

- Integration of electronic and computer operations
- Supporting of telecommunications needs
- Increased and active role of the textile parts (Textile parts are not only carriers of the electronic systems)

Examples of e-textiles applications

- Wearable motherboard
- Embedded Mobile phones
- Embedded Mp3 players
- Embedded GPS

Electrically conductive yarns

- Transfer of power
- Transmission of signals from and to:
  - Sensors
  - Transmitters
  - Microcontrollers etc.
- Traditional use in:
  - Heating
  - Electromagnetic protection

Electrically conductive fibres

- Textile polymers are isolators
- Electrical conductivity is reached by:
  - Modification of the structure of the polymer
  - Addition of conductive materials

Metallic wires and tapes

- Interlaced into the fabric structure
- Limited flexibility
- Increased weight
- Cutting problems
- Main application in electromagnetic shielding

Modification of the structure of the fabrics

- Impregnation using antistatic agents
- Coating using conductive substances

Electrically conductive polymers

- Polyaniline
- Polyamide-11
- Polyvinilalcohol

Drawbacks:

- Limited flexibility
- Use only in blends with conventional fibres

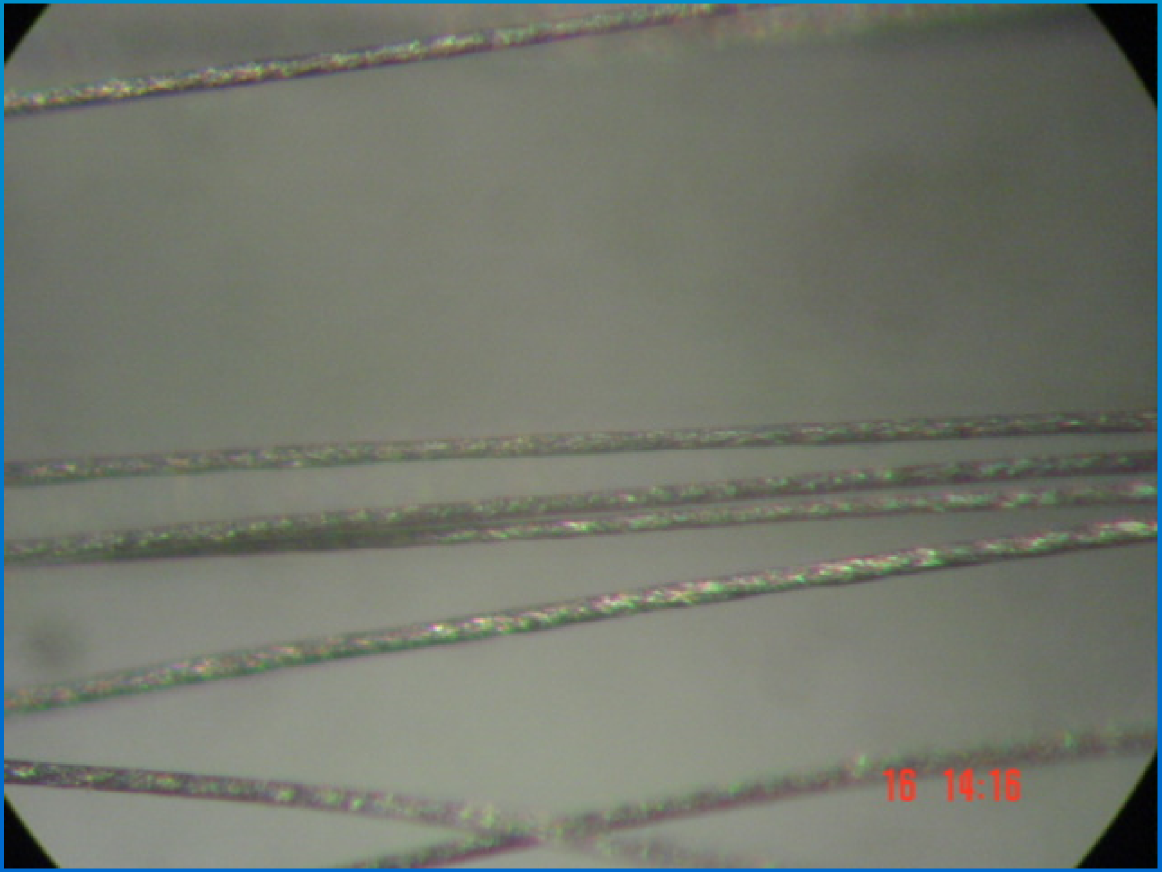
Modification of polymers

- Filling with electroconductive powder
- Vacuum spread metal
- Galvanic coating
- Chemical coating

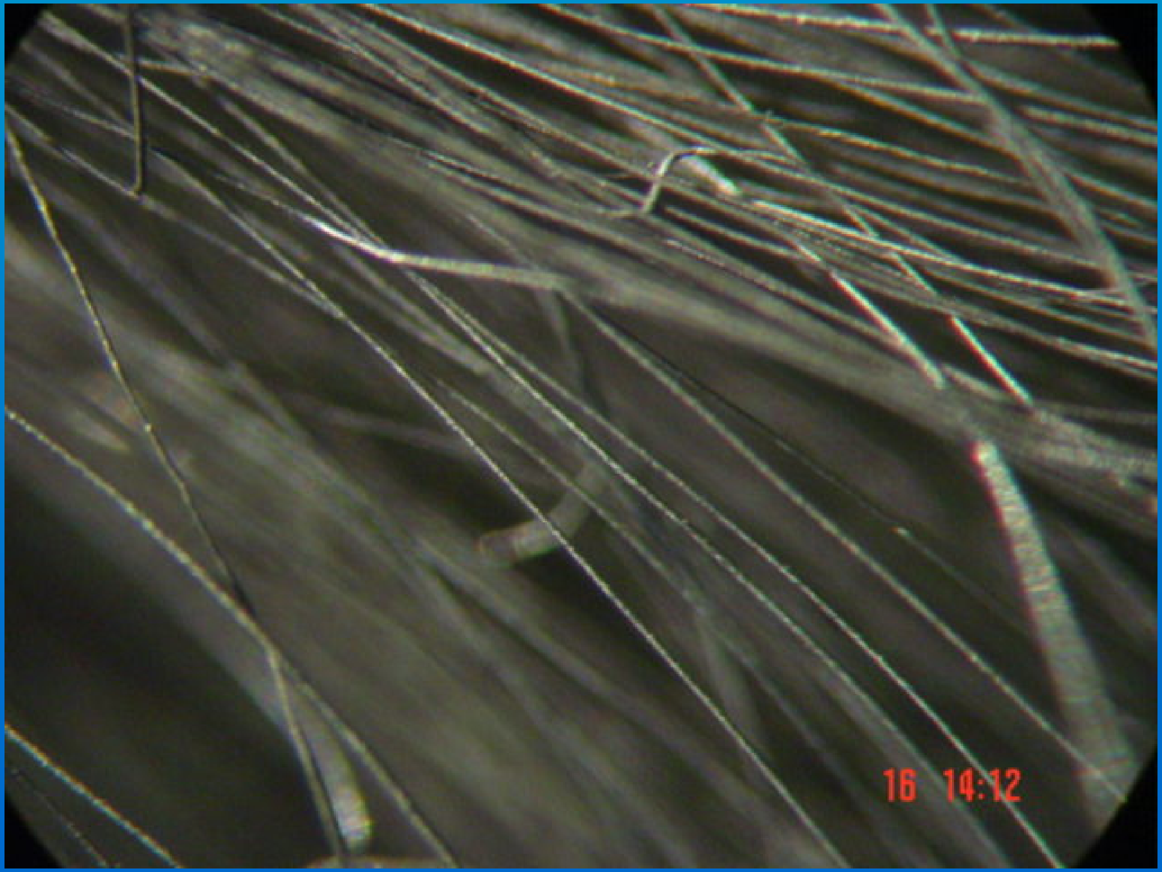
Metallisation of acrylic fibres

- Process after the spinneret (gel phase)
- Immersion in bath containing Ni salts
- Washing and drafting
- Metal content 3-4%
- After galvanic treatment: 15%

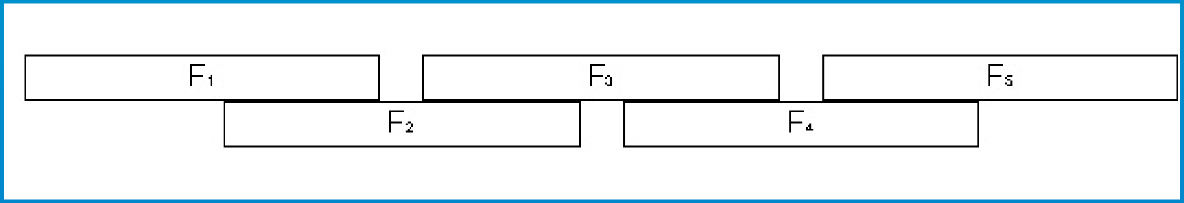
Microscopic view of metallized acrylic fibres

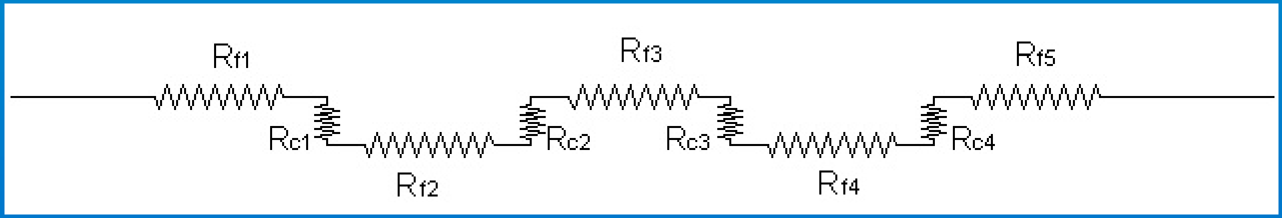


Microscopic view of metallized acrylic fibres



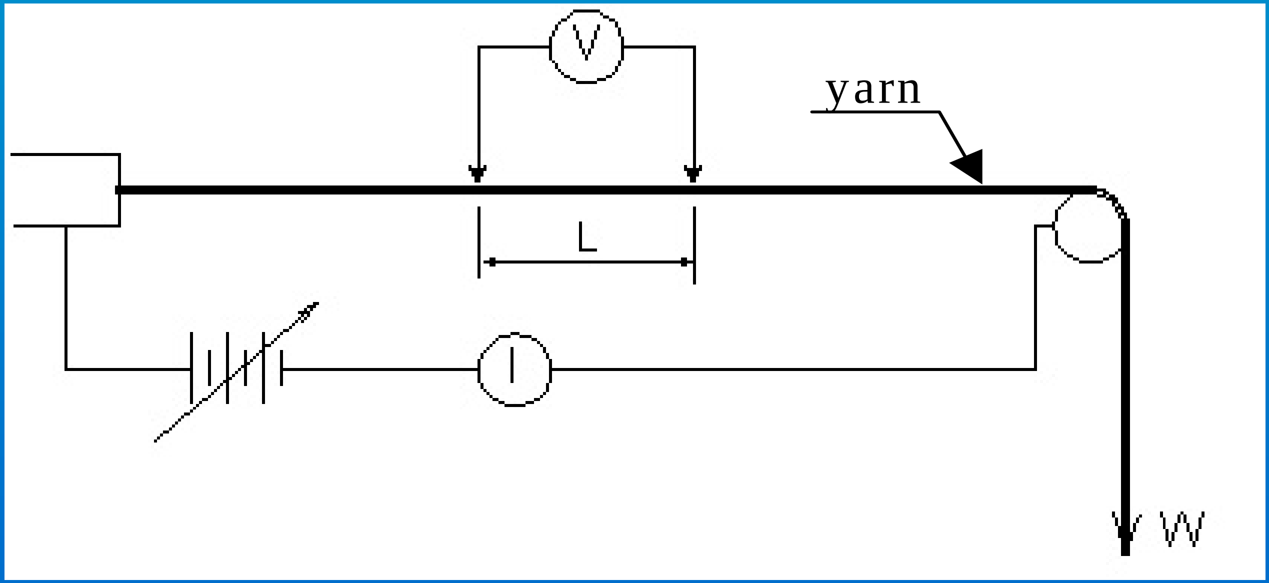
Electrically conductive yarns



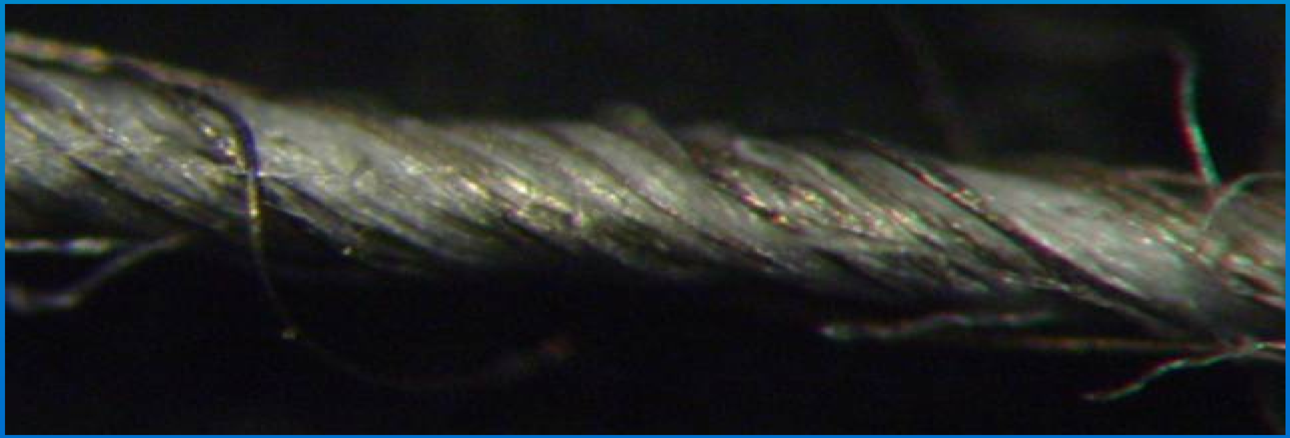


$$R_{tot} = \sum_{i=1}^{n} R_{fi} + \sum_{j=1}^{m} R_{cj}$$

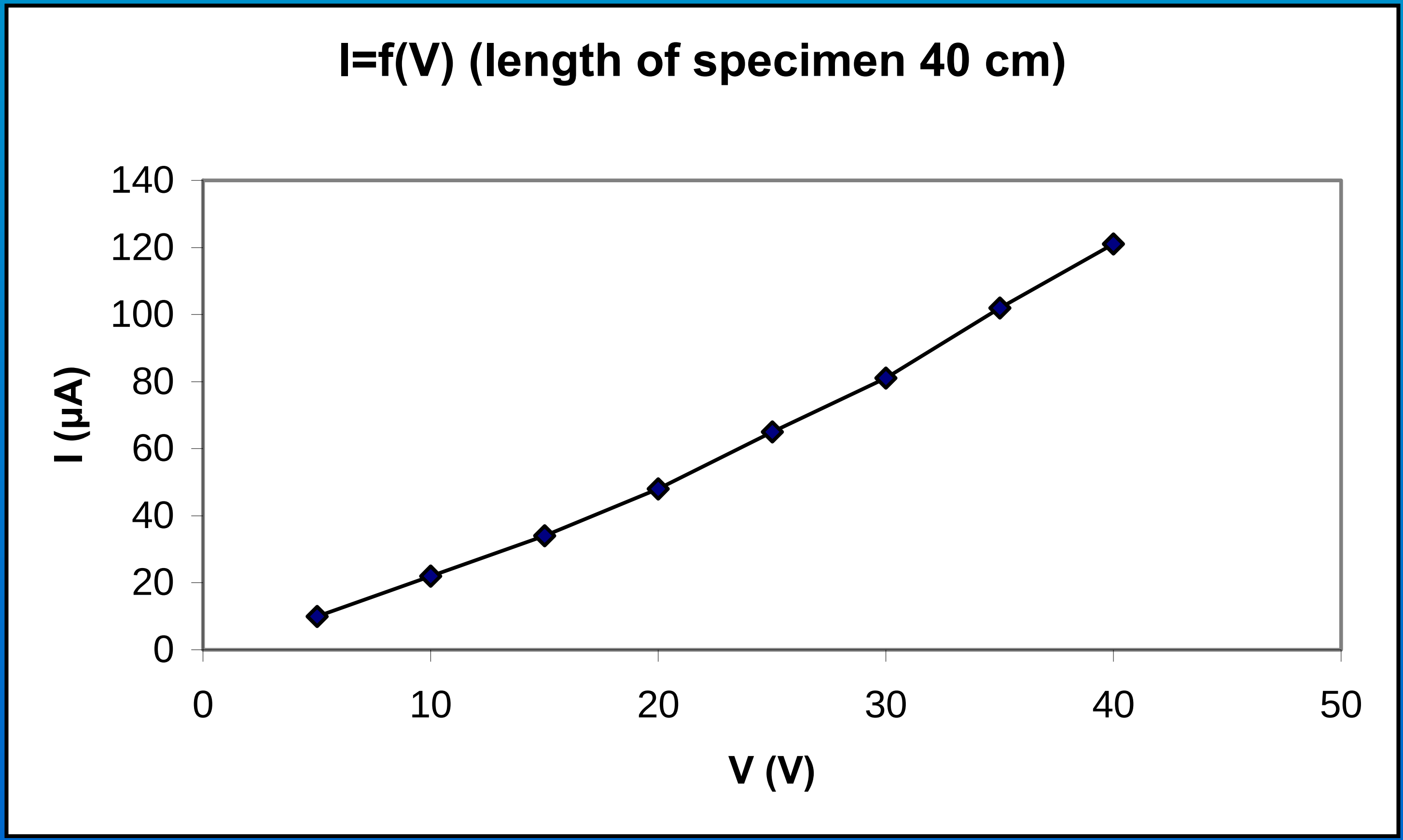
Set-up for DC measurements



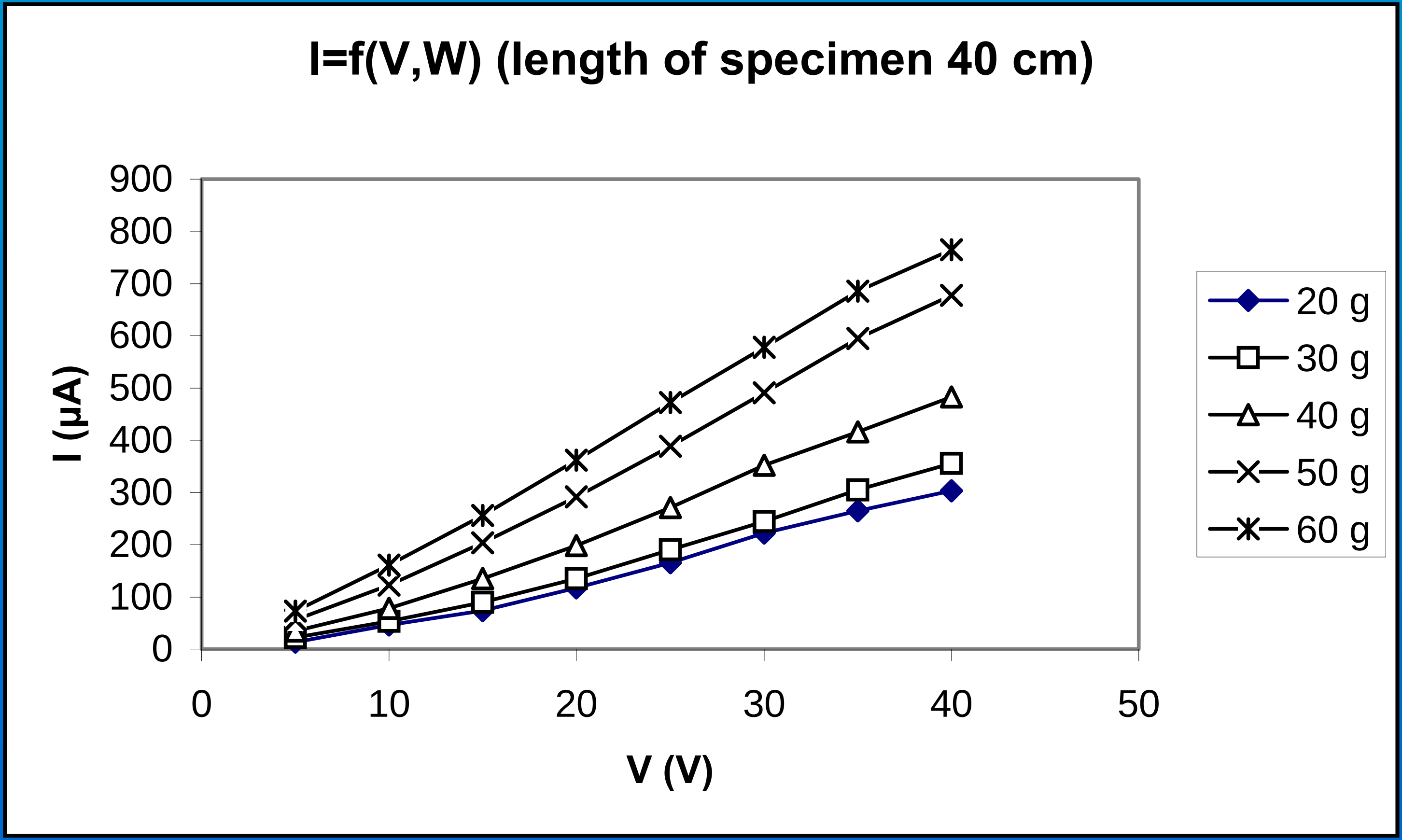
View of a blended acrylic conductive yarn



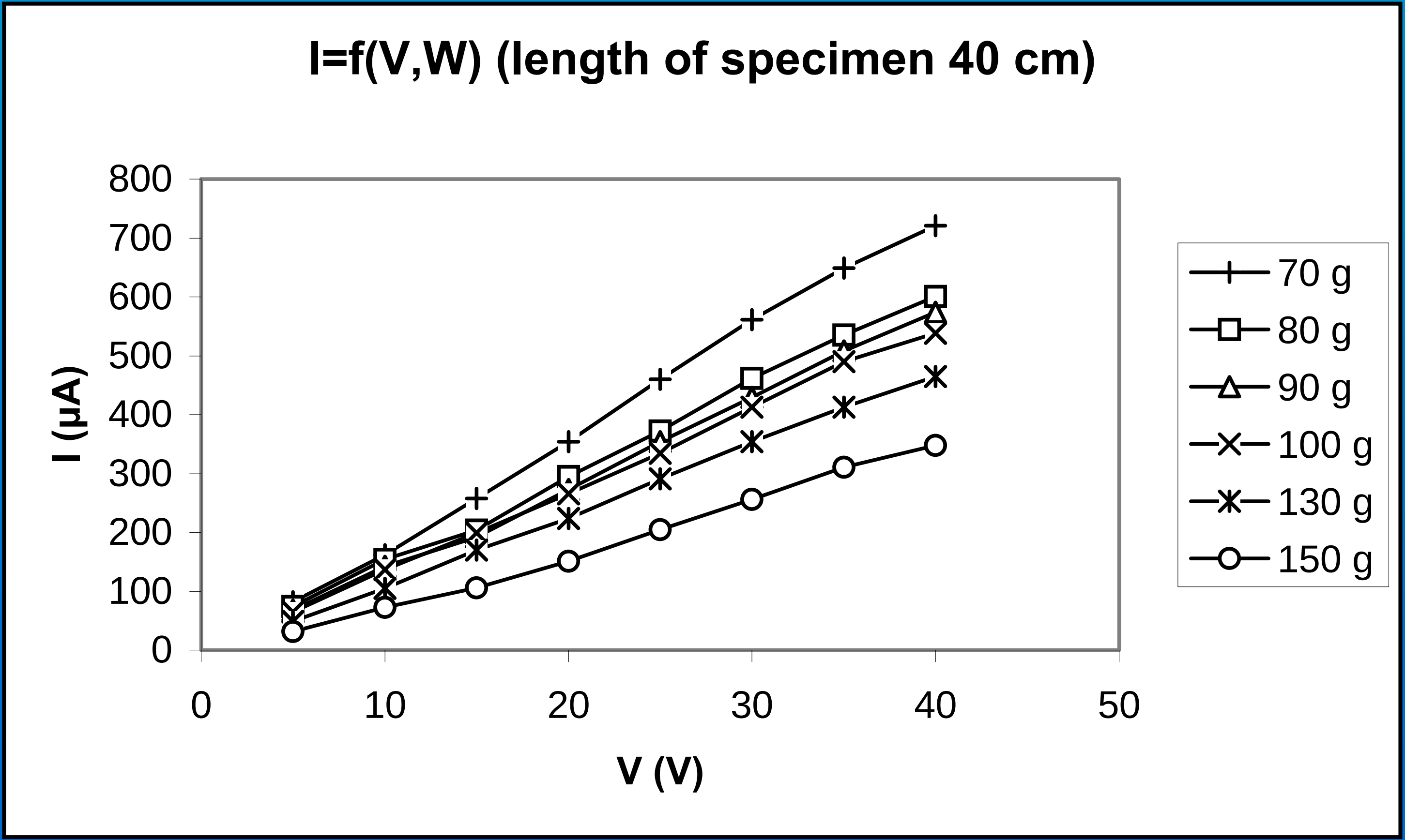
Electrical behaviour of a yarn in relaxed condition



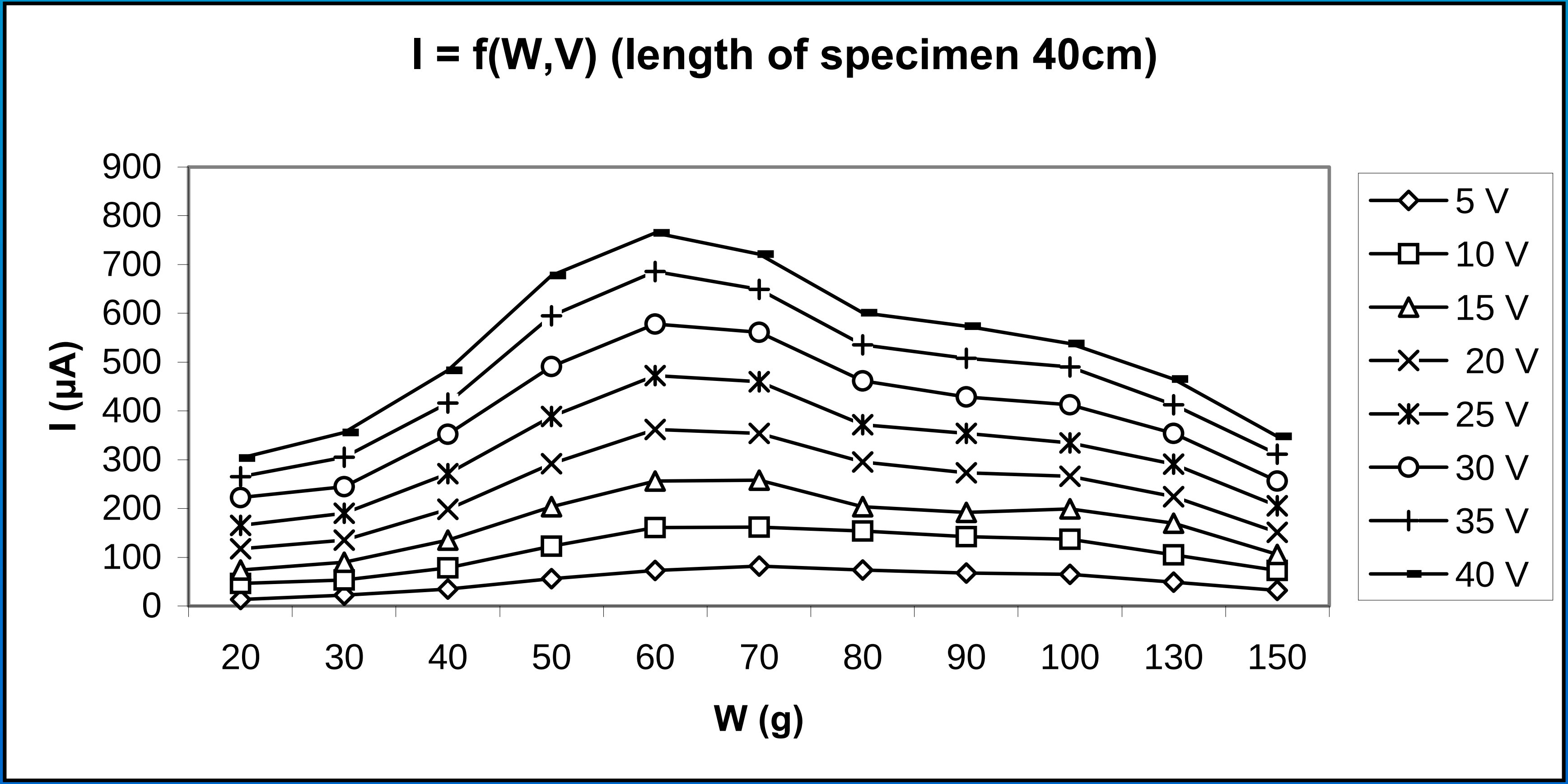
Electrical conductivity vs mechanical loading (a)



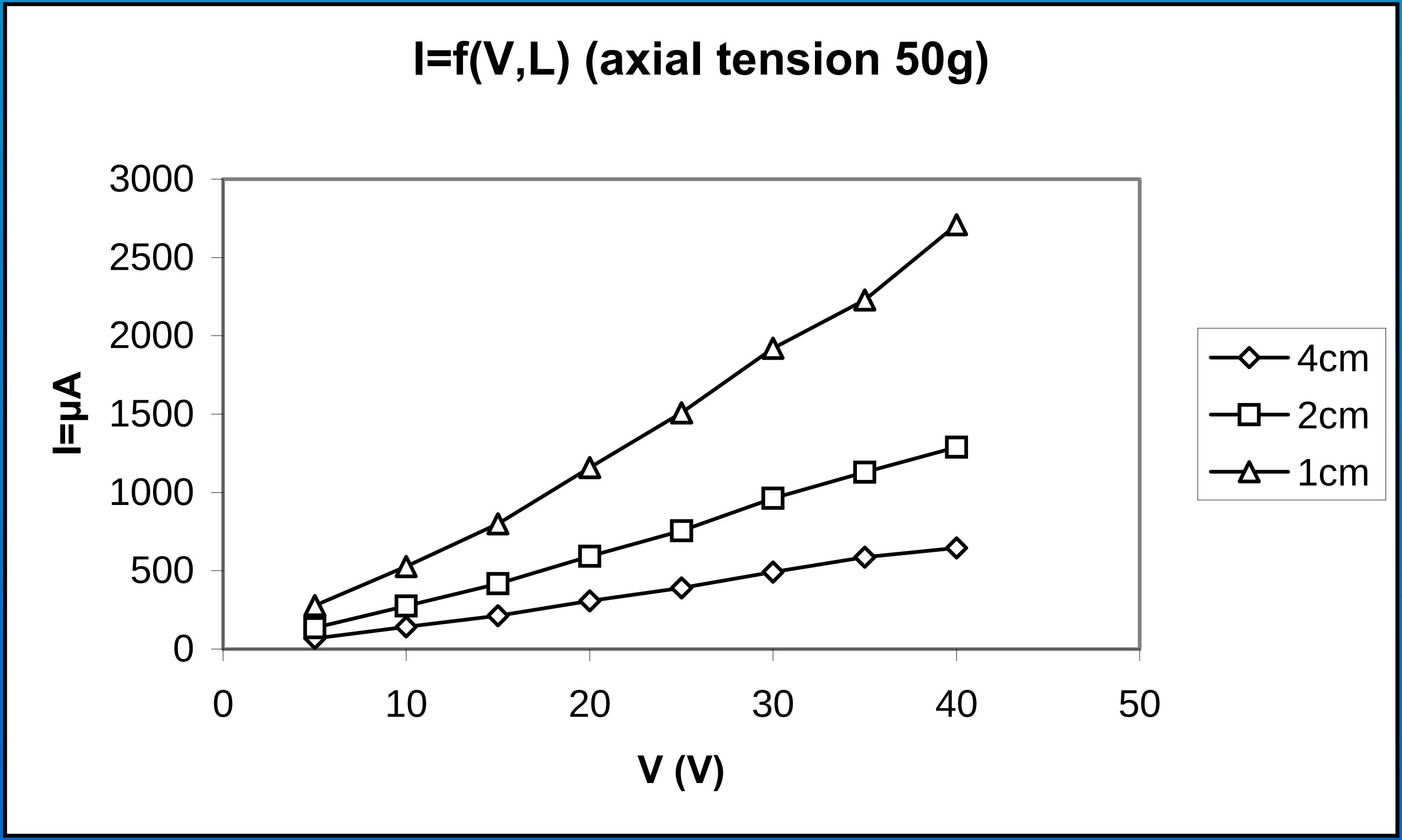
Electrical conductivity vs mechanical loading (b)



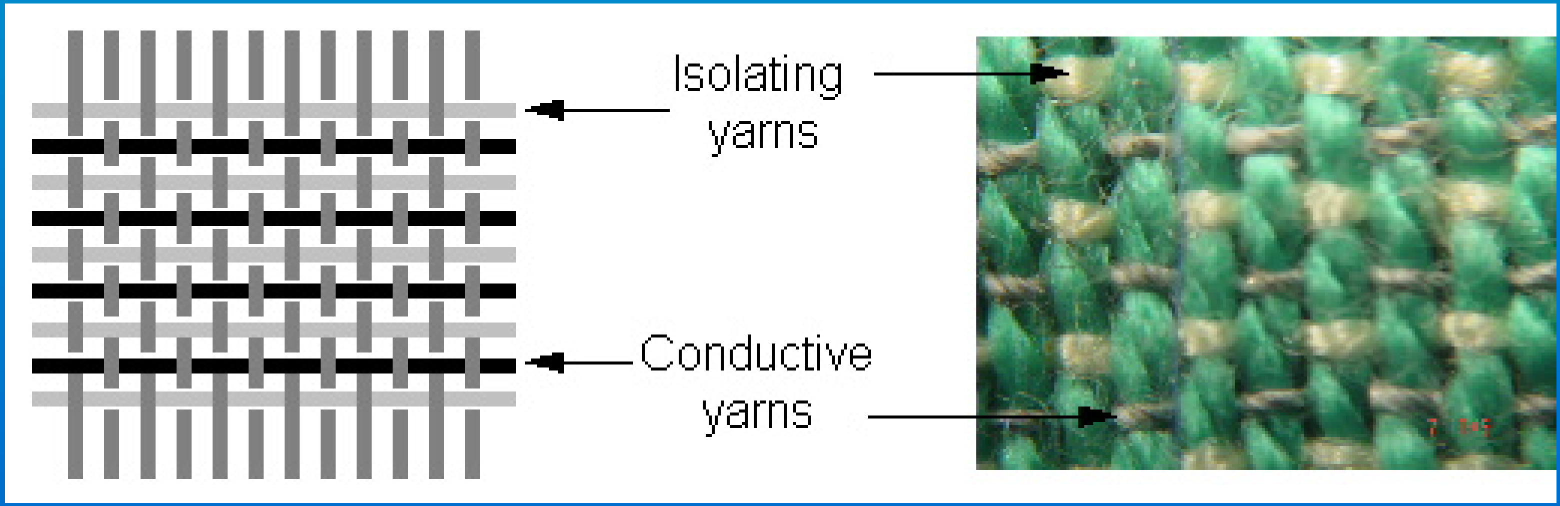
Electrical conductivity vs mechanical loading (c)



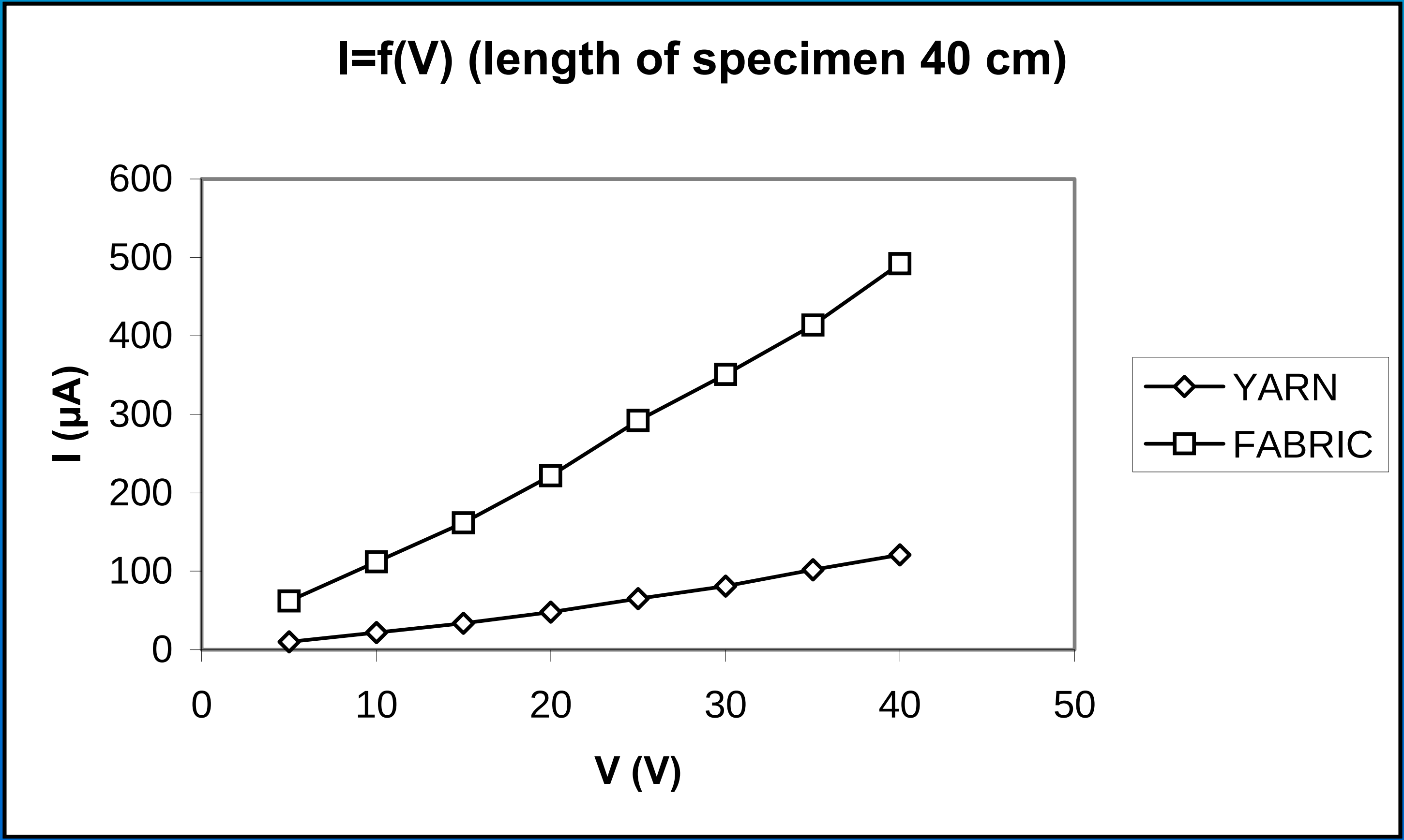
Conductivity over various lengths of specimens



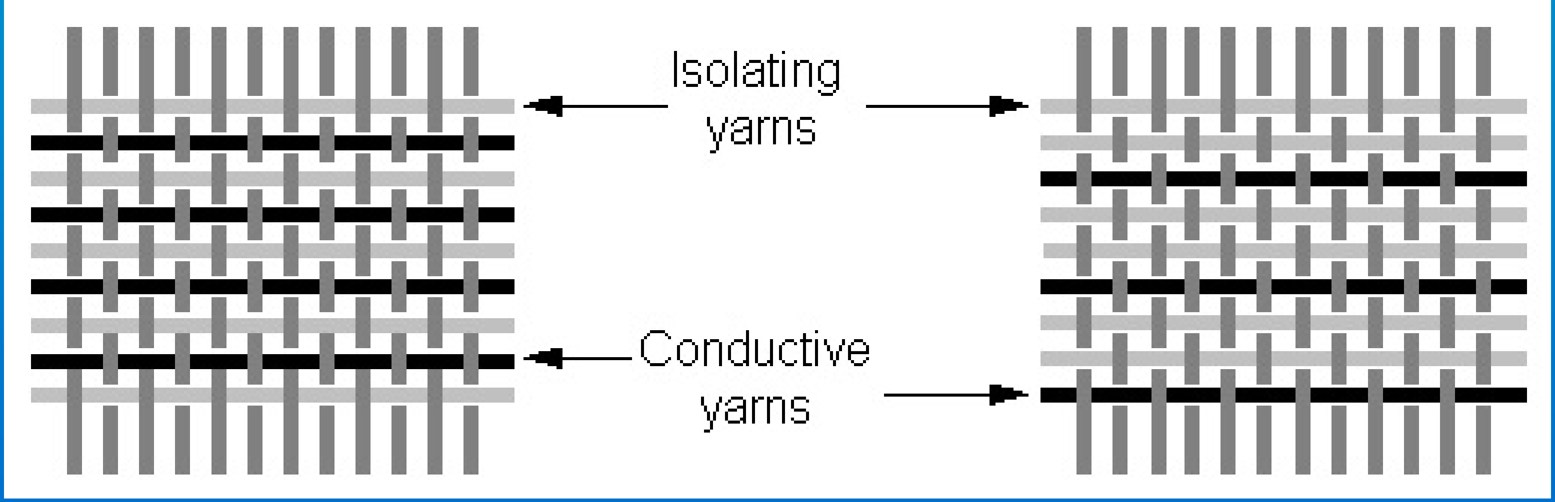
Electrically conductive fabric



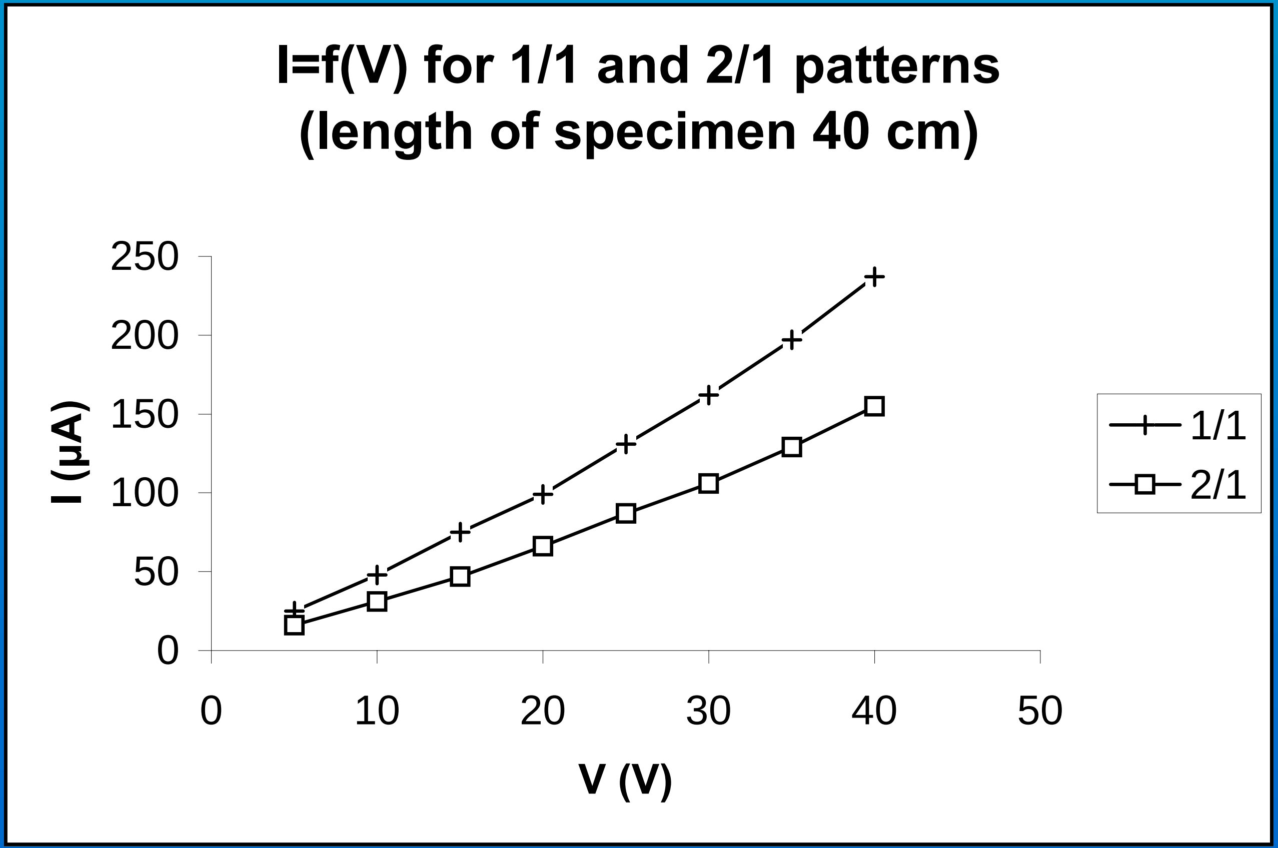
Conductivity in free and weaved condition



1/1 and 2/1 fabrics

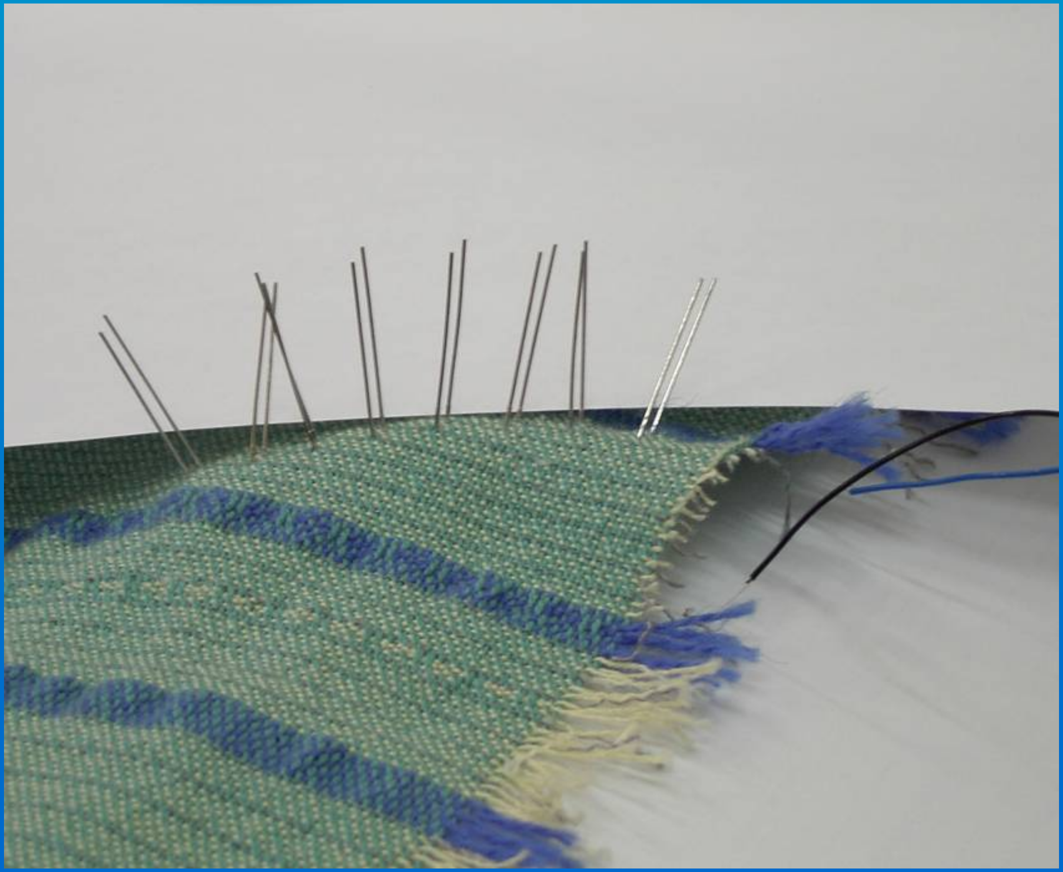


Conductivity of 1/1 and 2/1 patterns

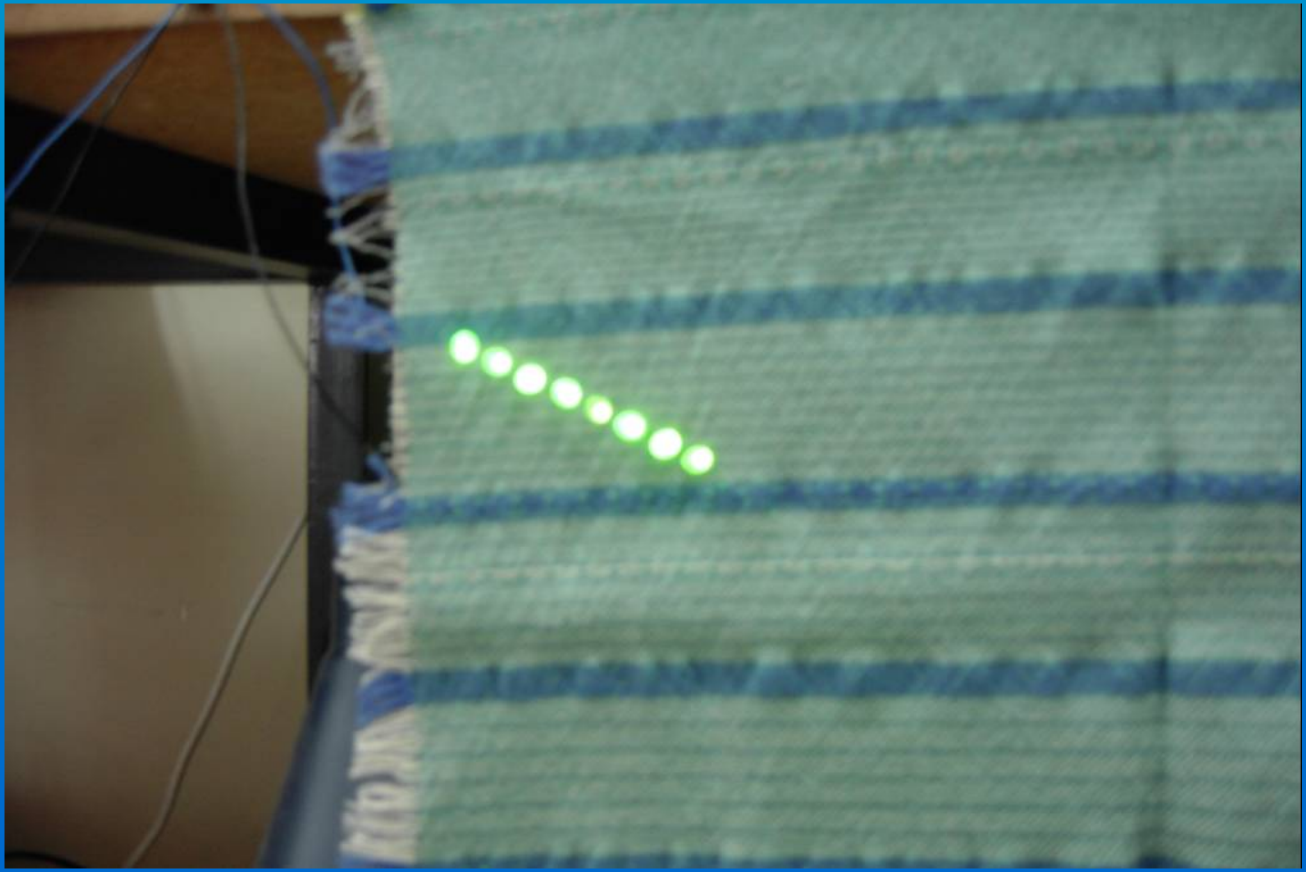


Use of conductive fabric (1)

Use of conductive fabric (2)



Use of conductive fabric (3)



Use of conductive fabric (4)

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TEI PIRAEUS

NTUA