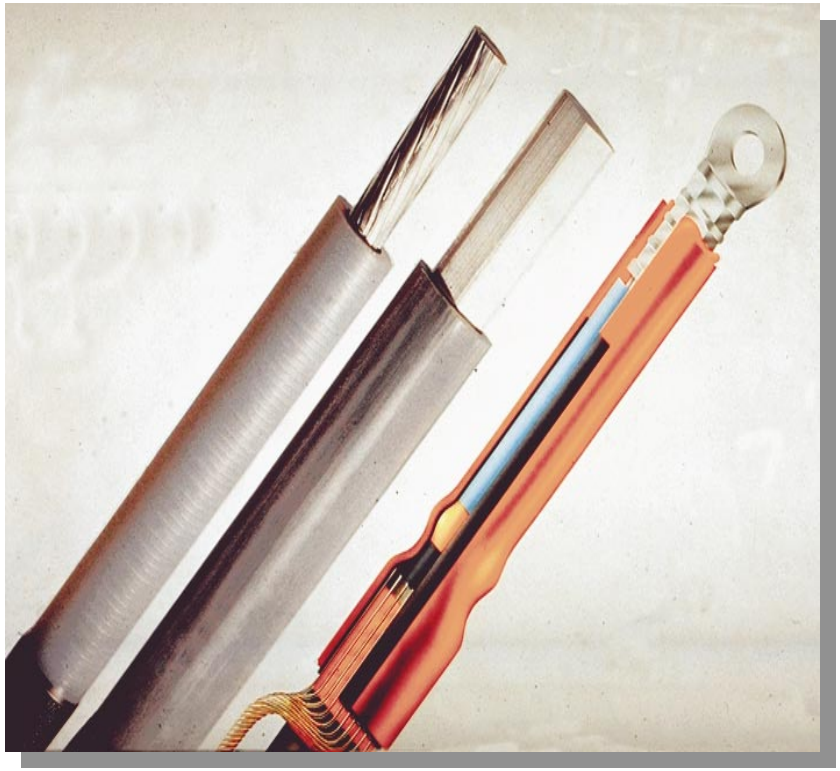
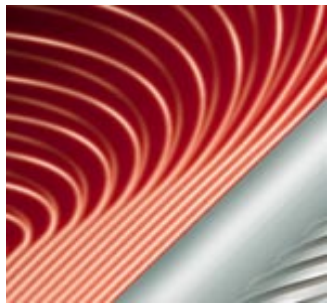


# Stress Control Technology Systems up to 72kV

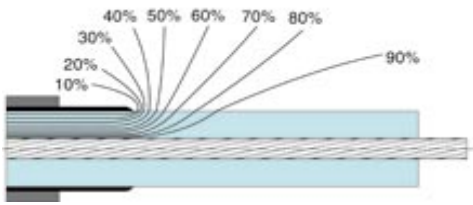
# Electrical stress control systems



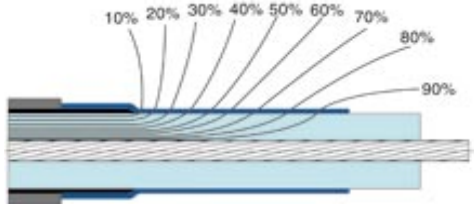
**Raychem developed technologies, where the specific impedance of semi-conductive polymers will be used.**

**These special products are used in different application for the control of the electrical field.**

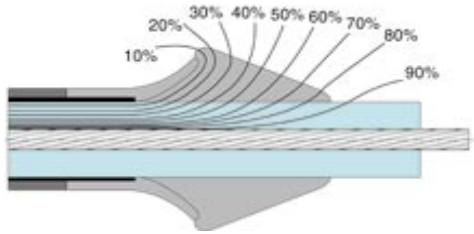
**No stress control**

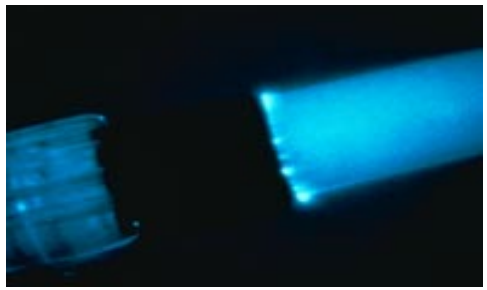



**Non-linear impedance stress control**

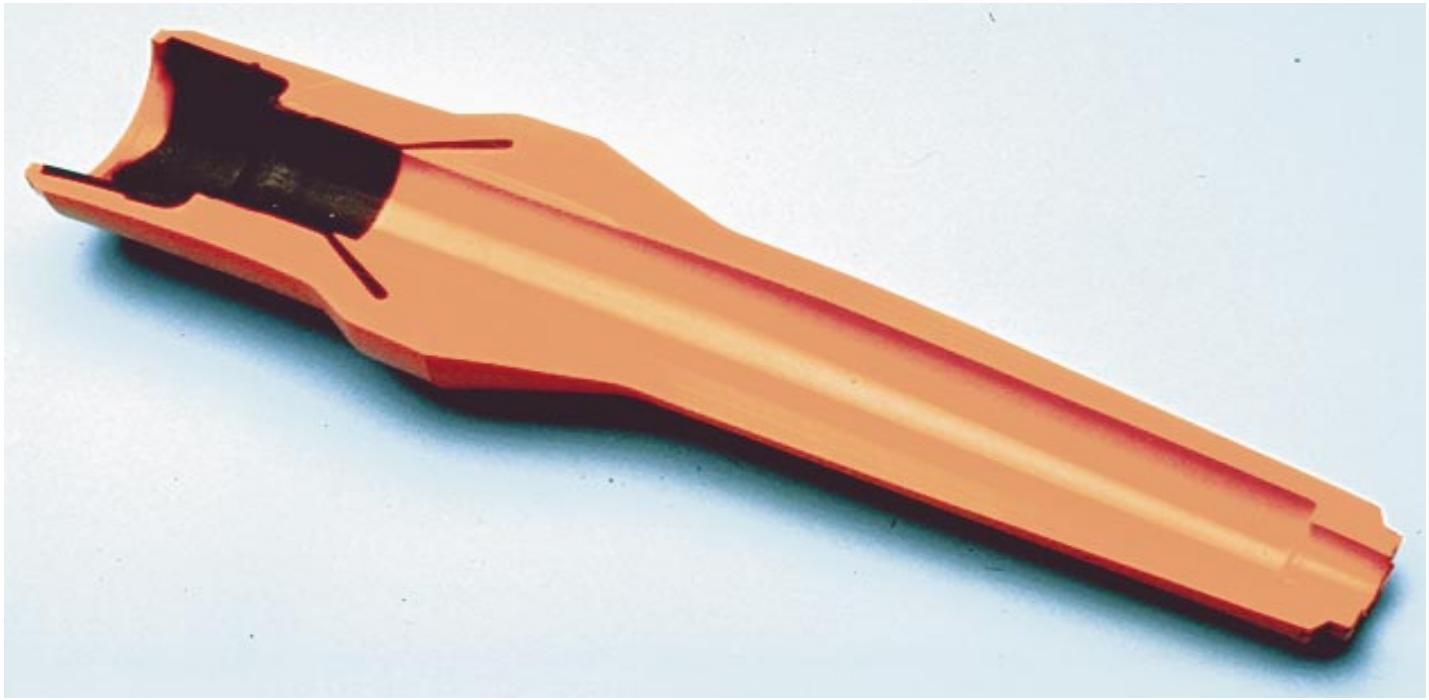



**Geometrical stress control**

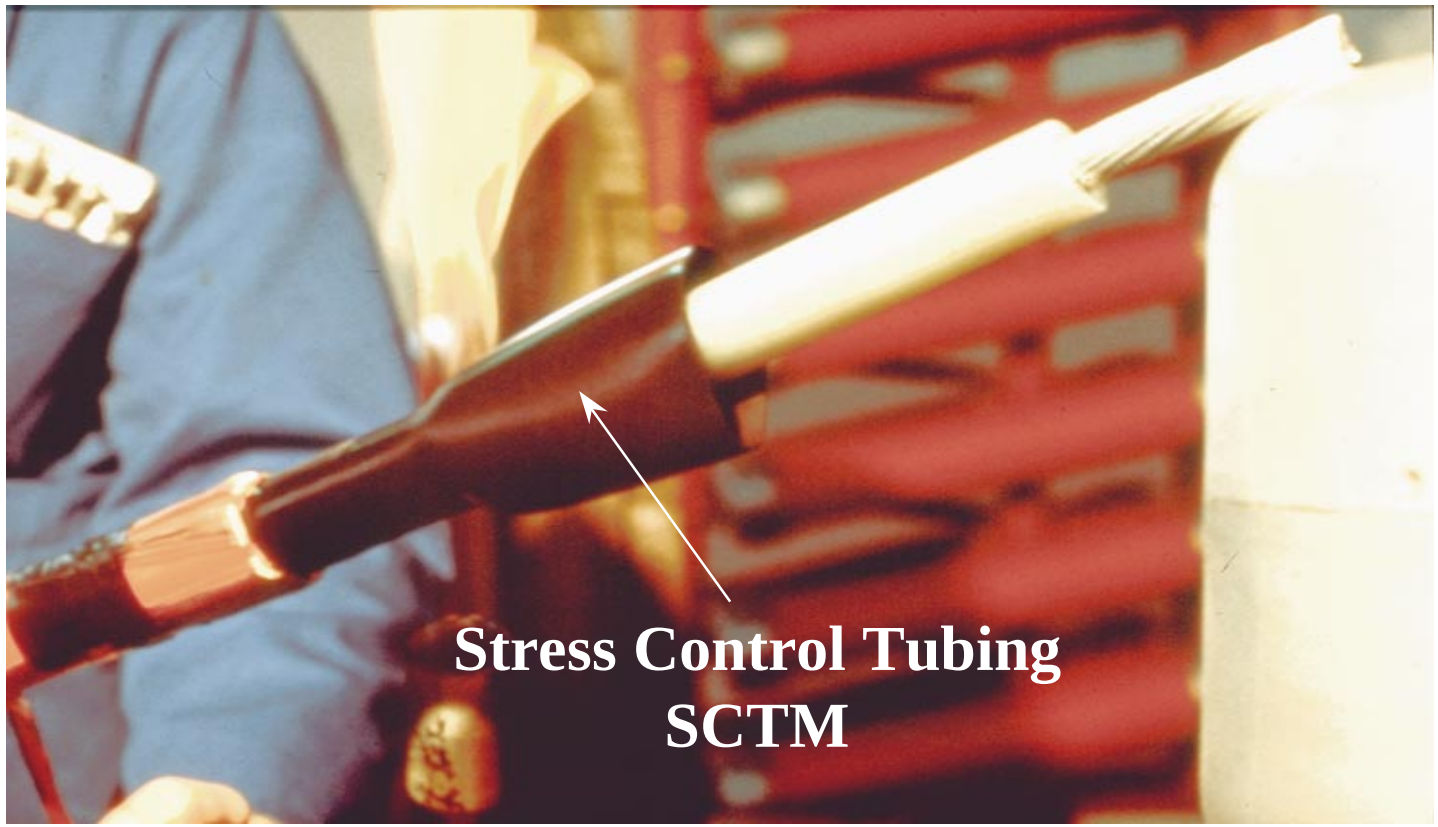


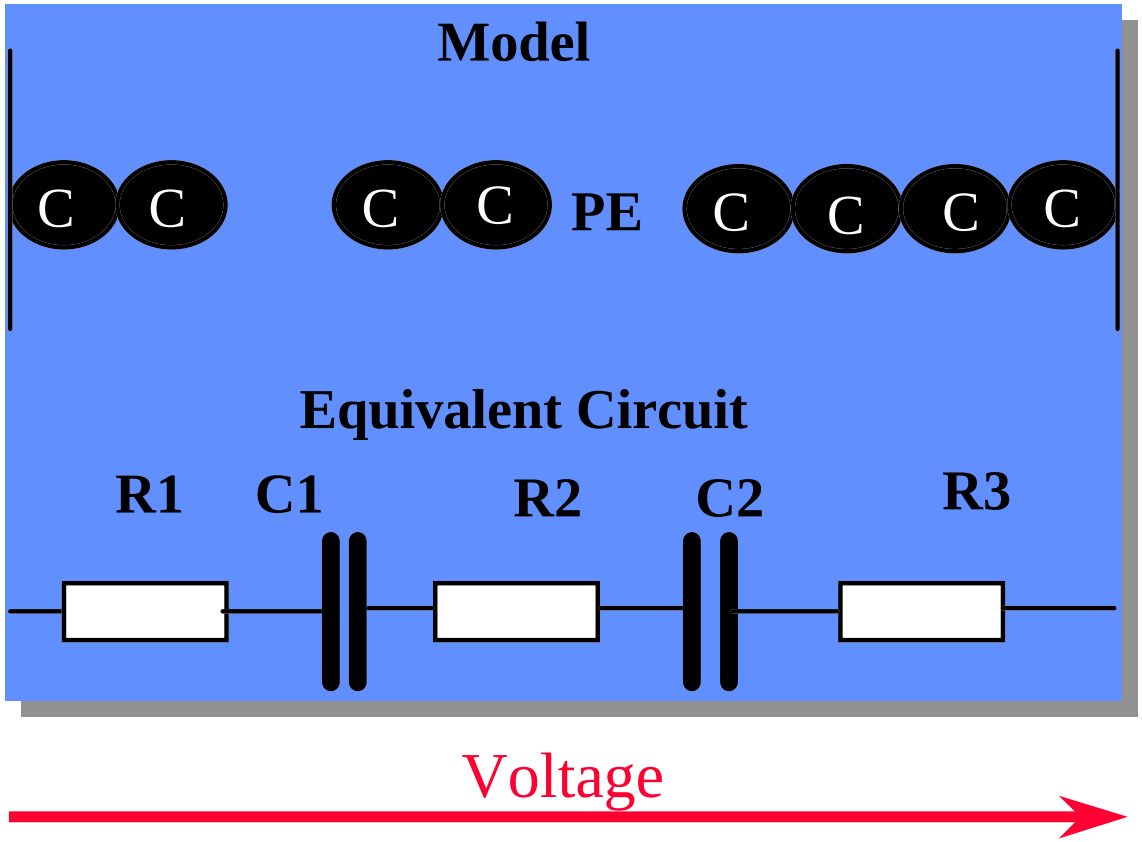
# Example: Geometric Stress Control



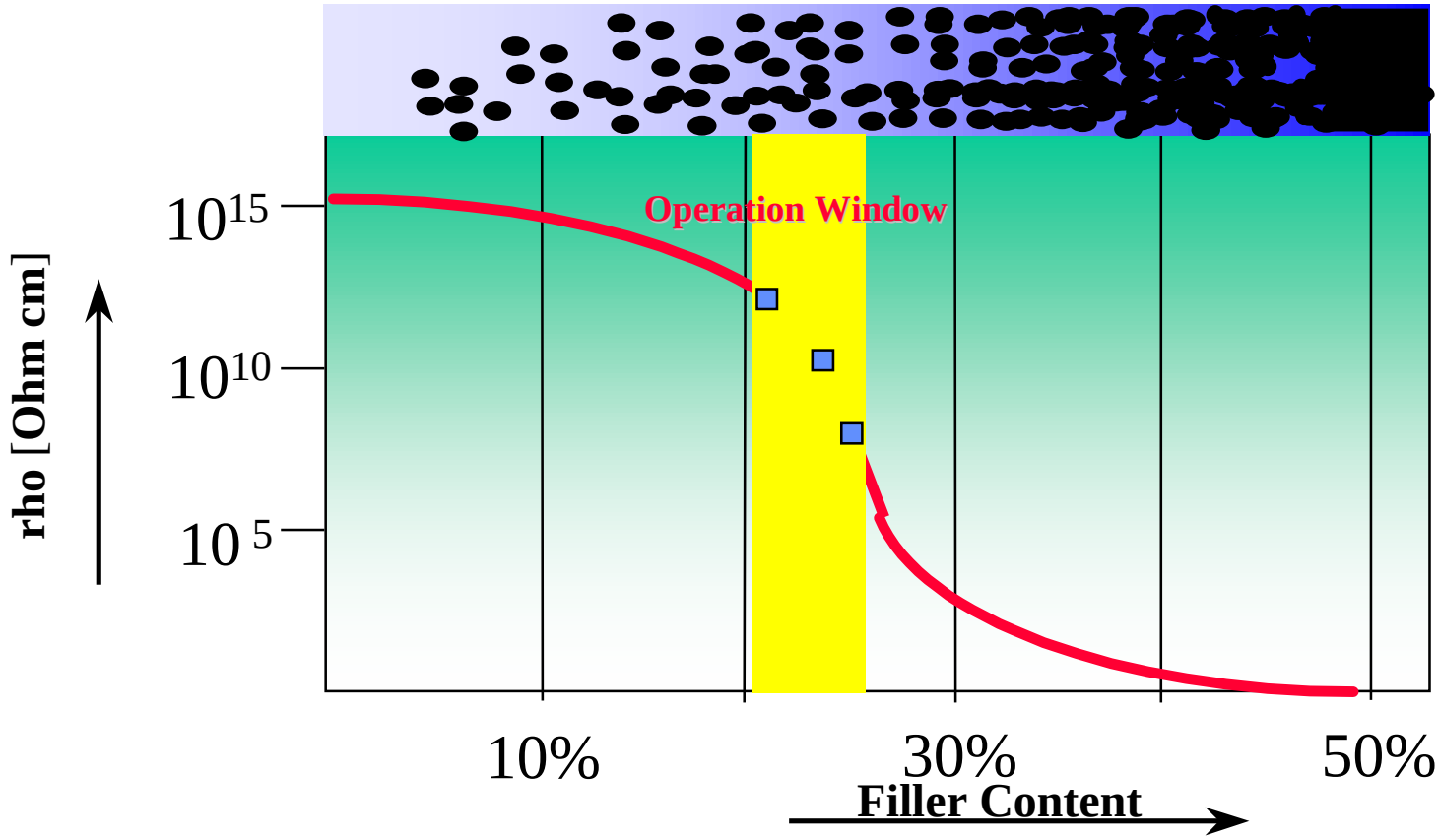
# Example: SCTM



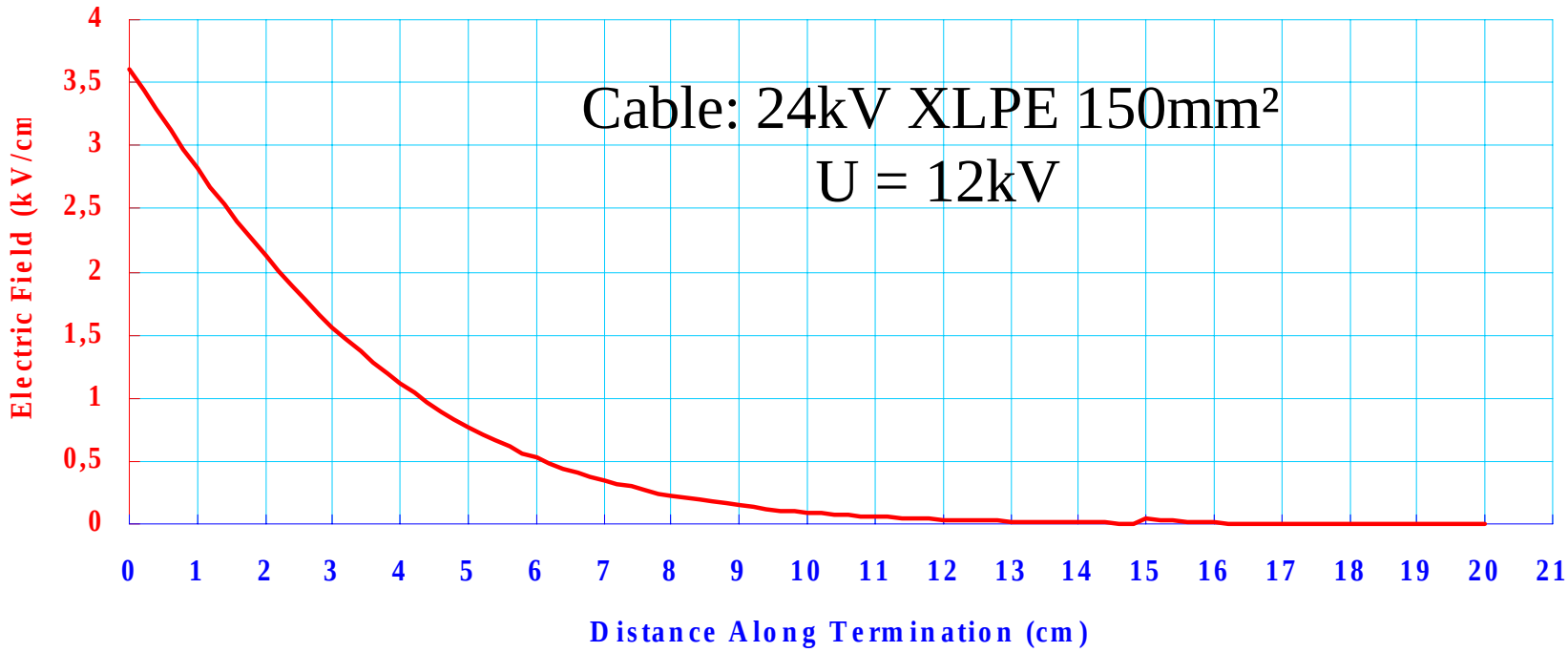
# Polymer Model

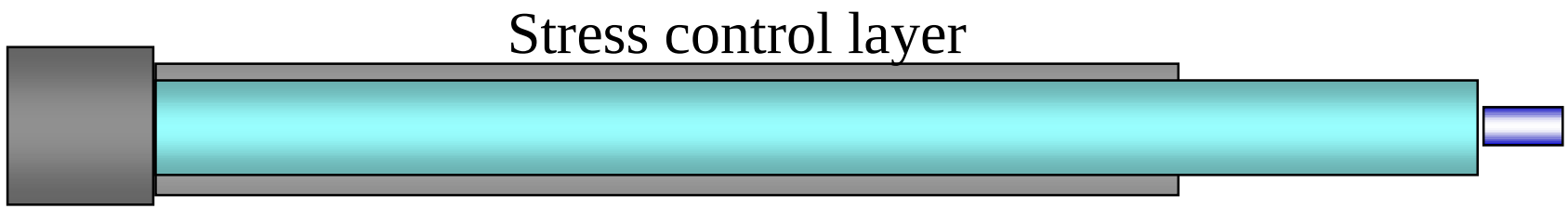


# SCTM Volume Resistance Filler

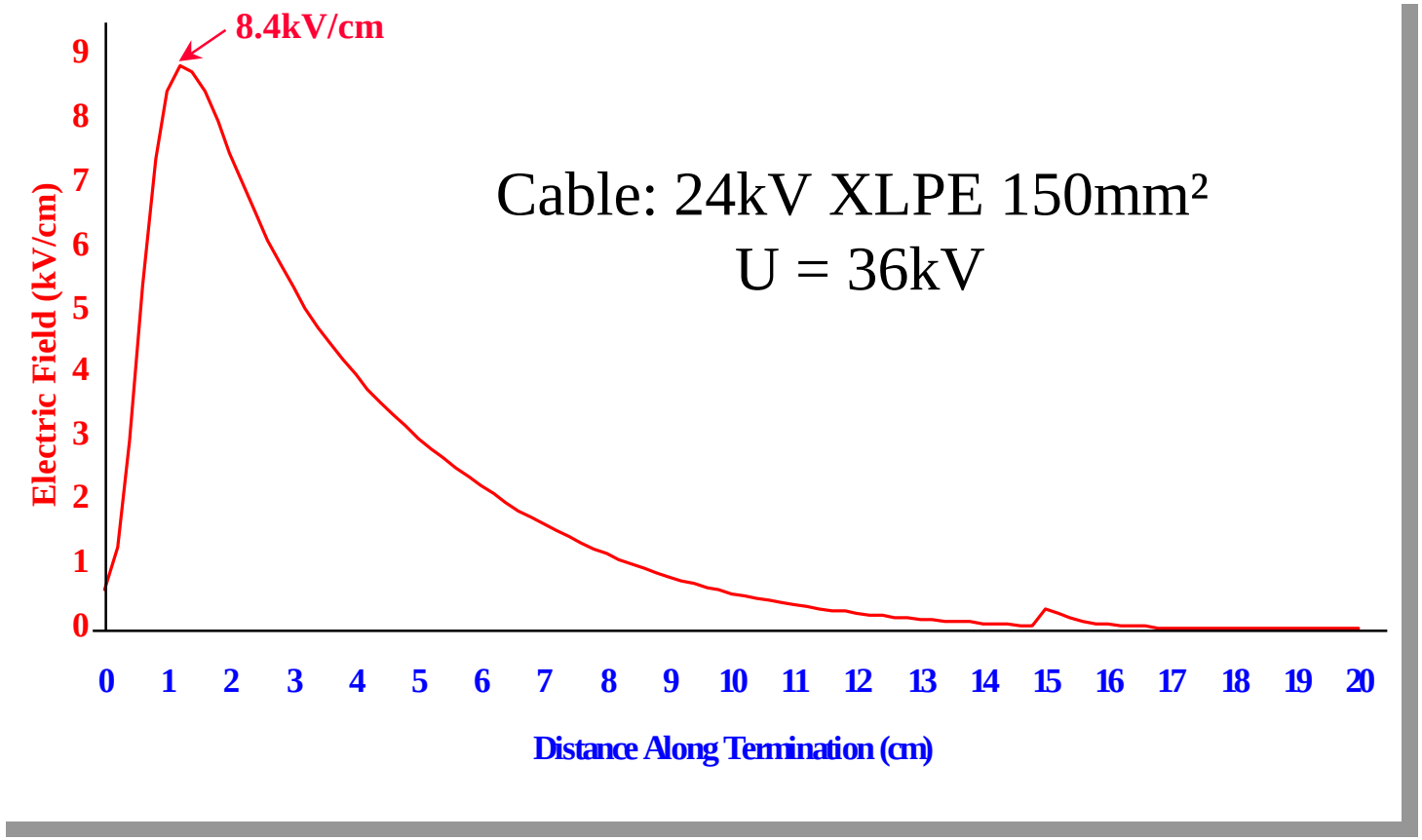


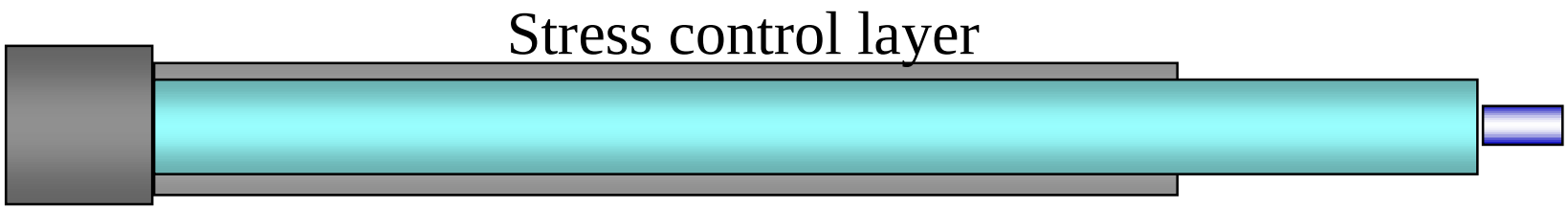
# Calculation of the E-distribution



# Calculation of the E-distribution with 3 times higher stress



# E-Field-Vector measured on Termination

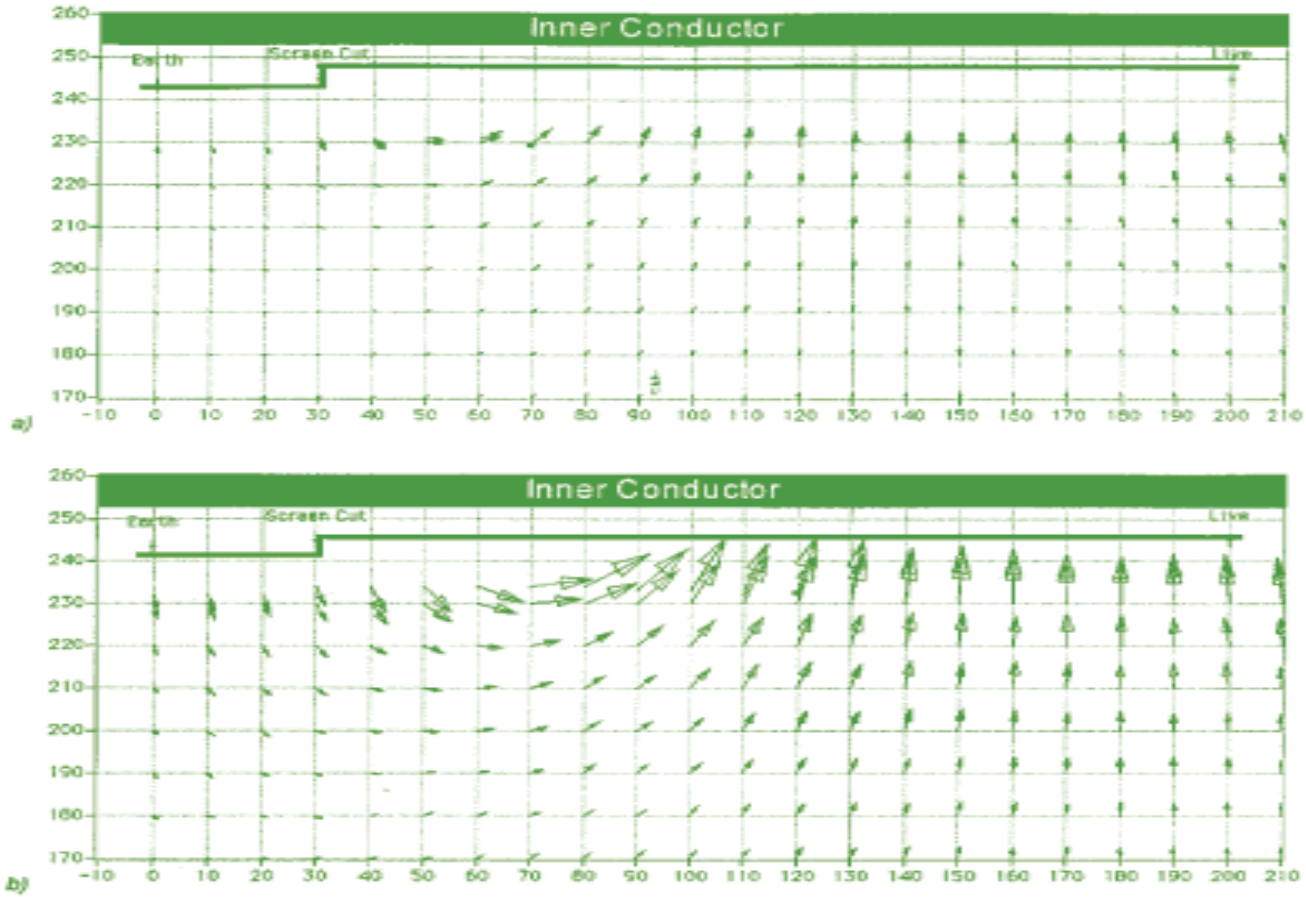
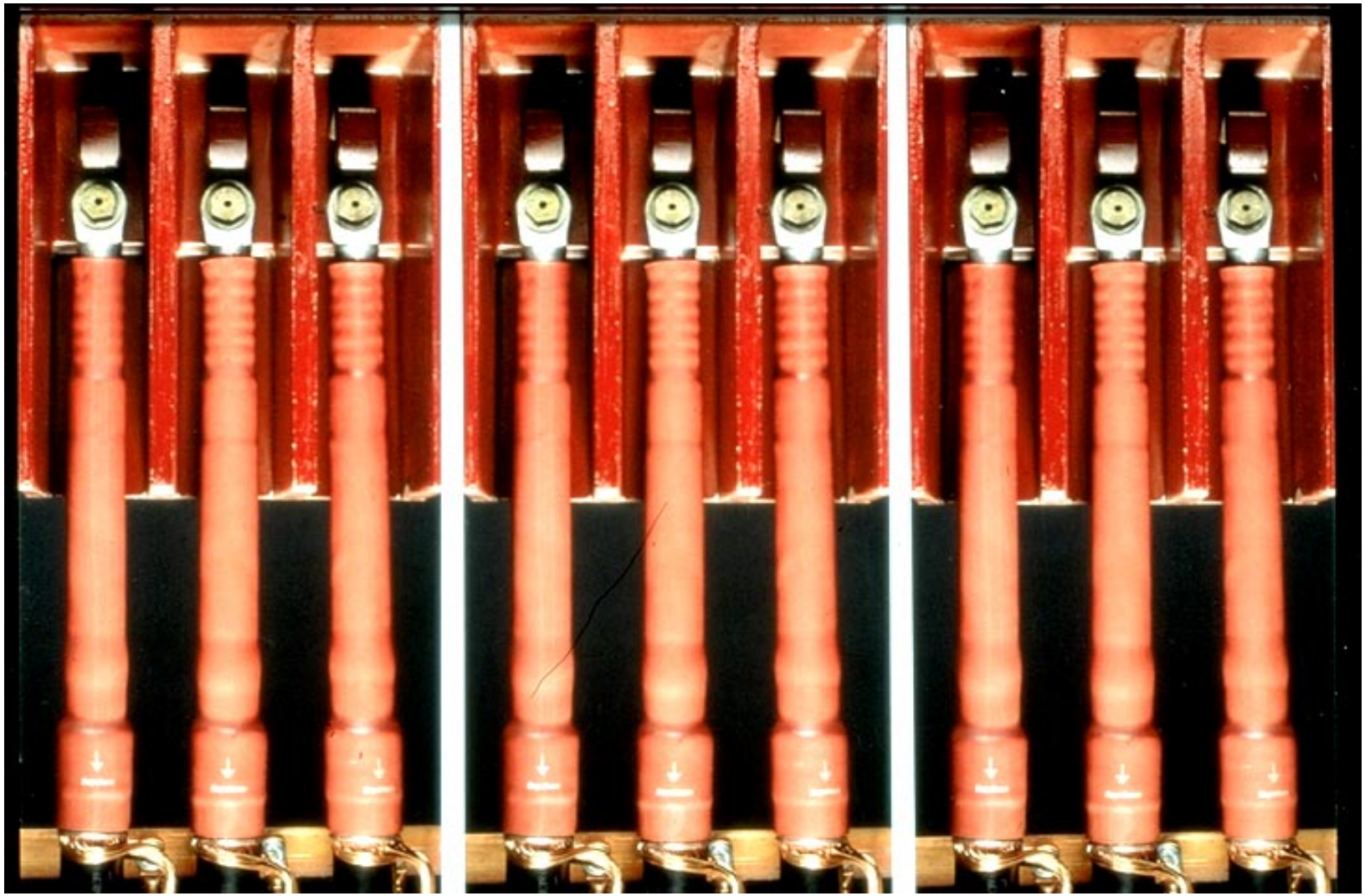
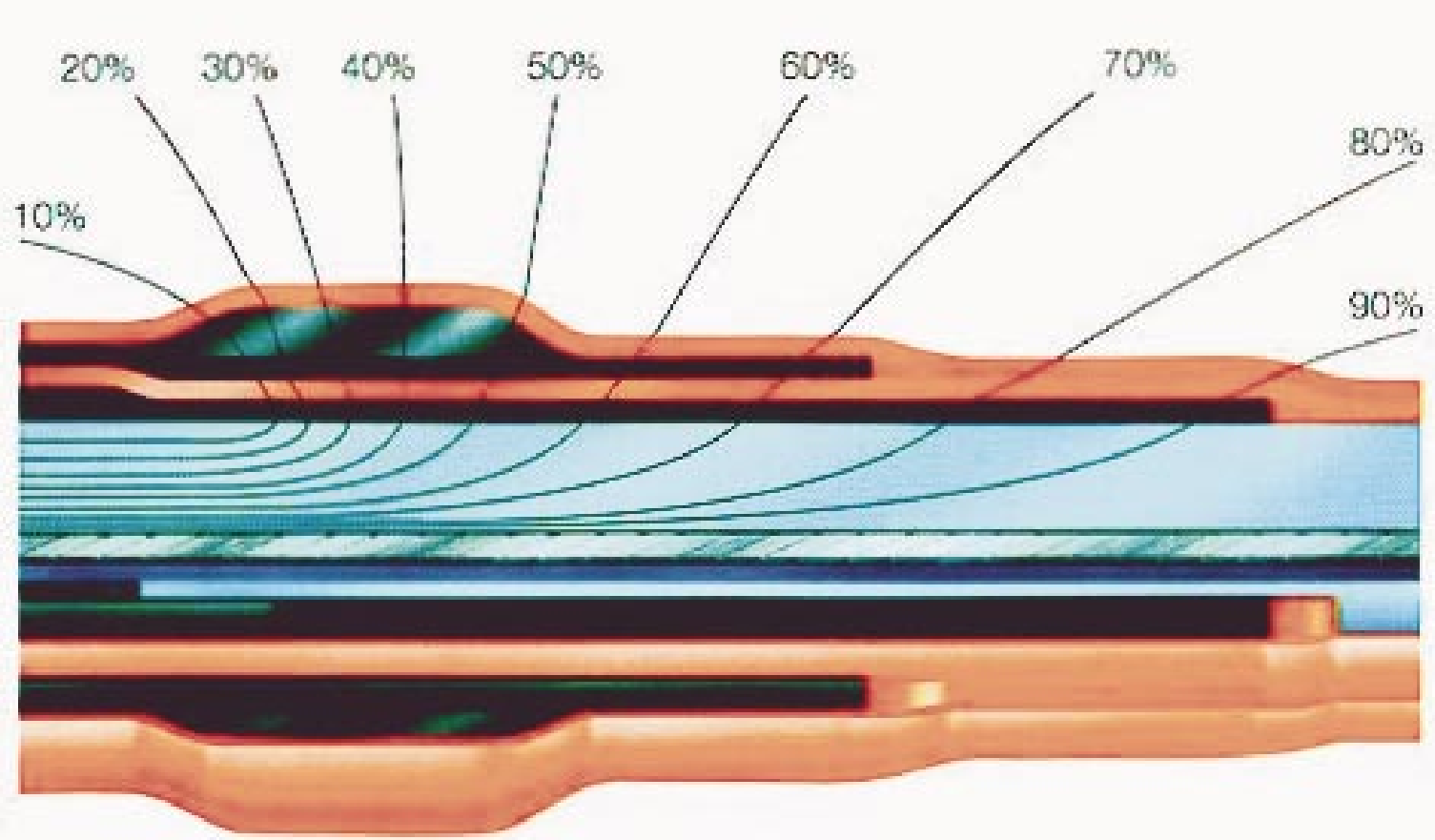



Fig. 4: Cable Termination with semiconductive stress control layer at
a) 5 kV and b) 30 kV

# 24kV Application

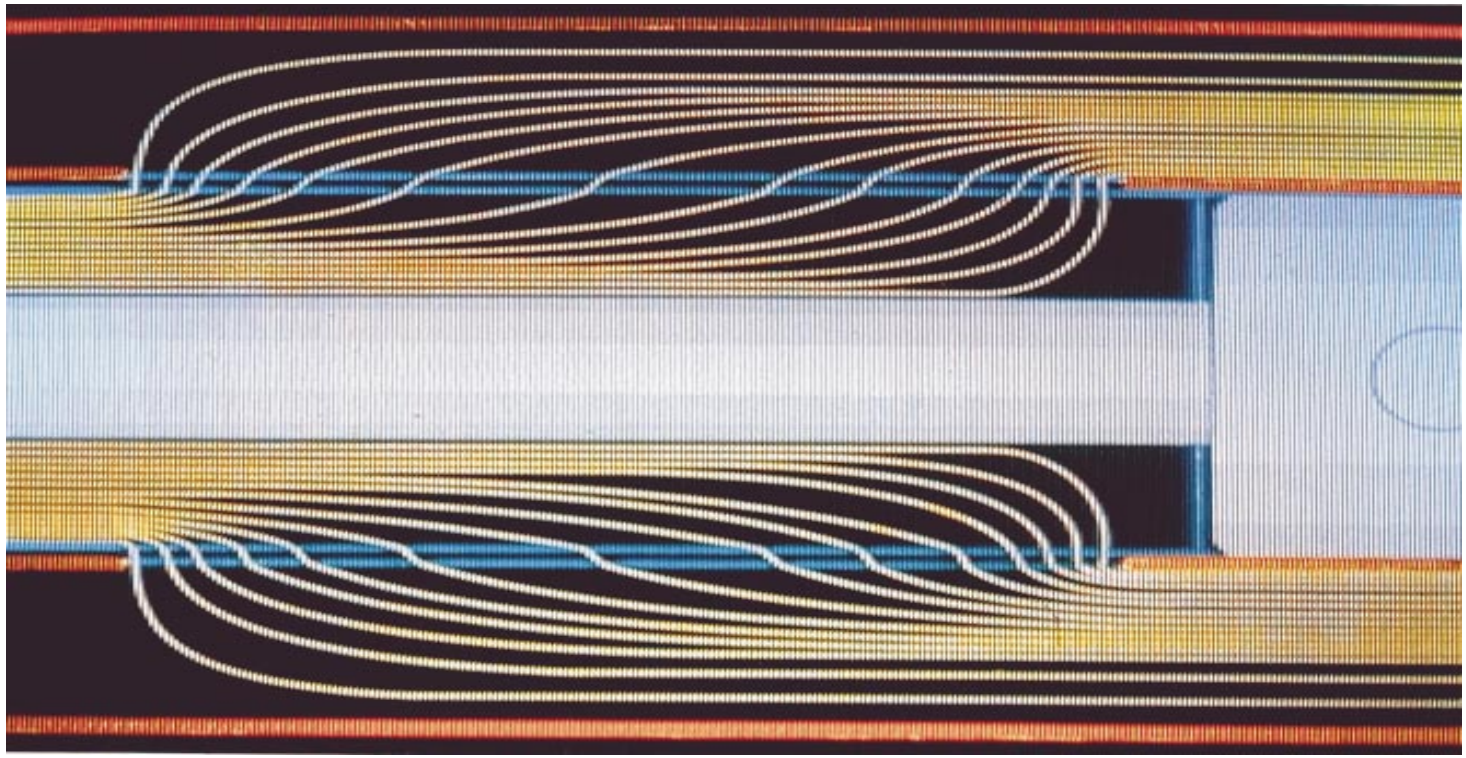


# 72kV Termination design



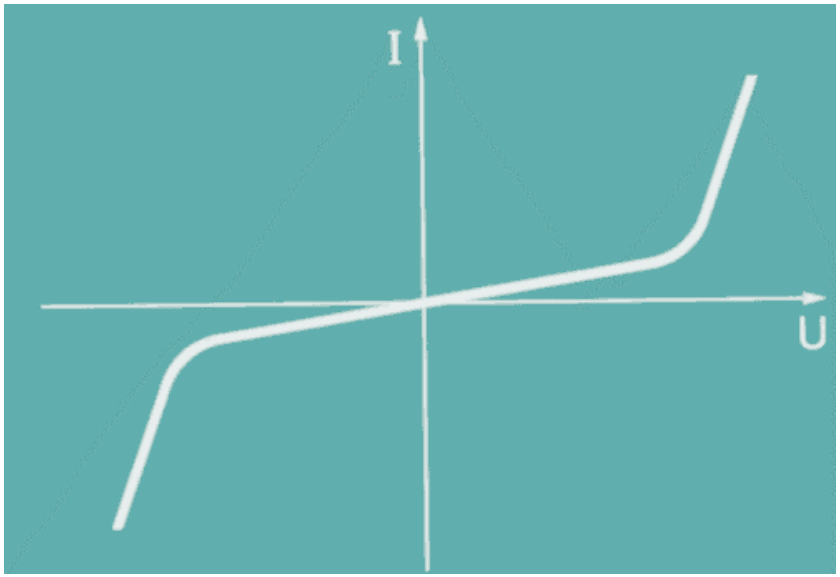

Stress plot of equipotentials

# Equipotential-Lines in Joints



# The Alternative for the Future

## Non-Linear Stress Control based on Zinc-oxid powder embedded in polymer matrix

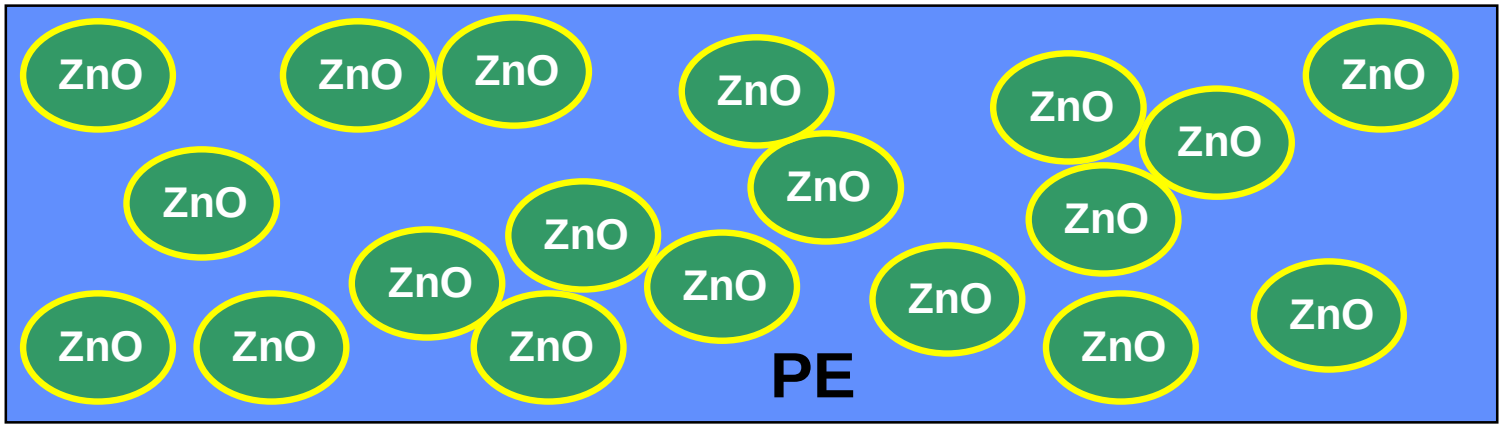



**derived from Raychem's experience in varistor technology**

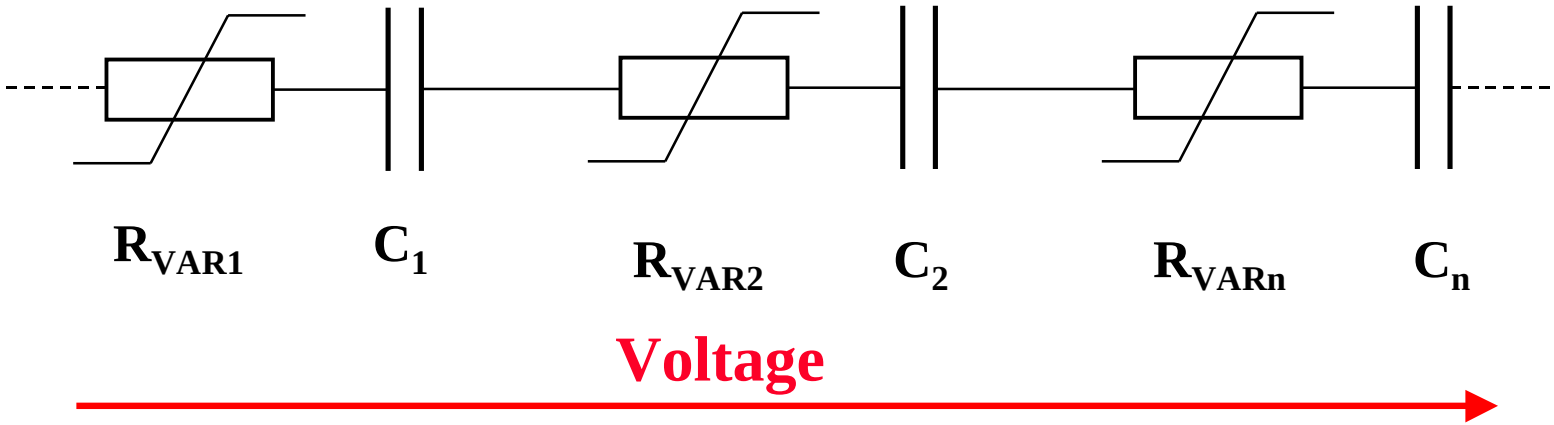
# Unigrade - ZnO Stress Control

- ZnO powder
- Calcined Powder
- Embedding in polymer matrix
- Extrusion or molding
- Application by heat or pressure

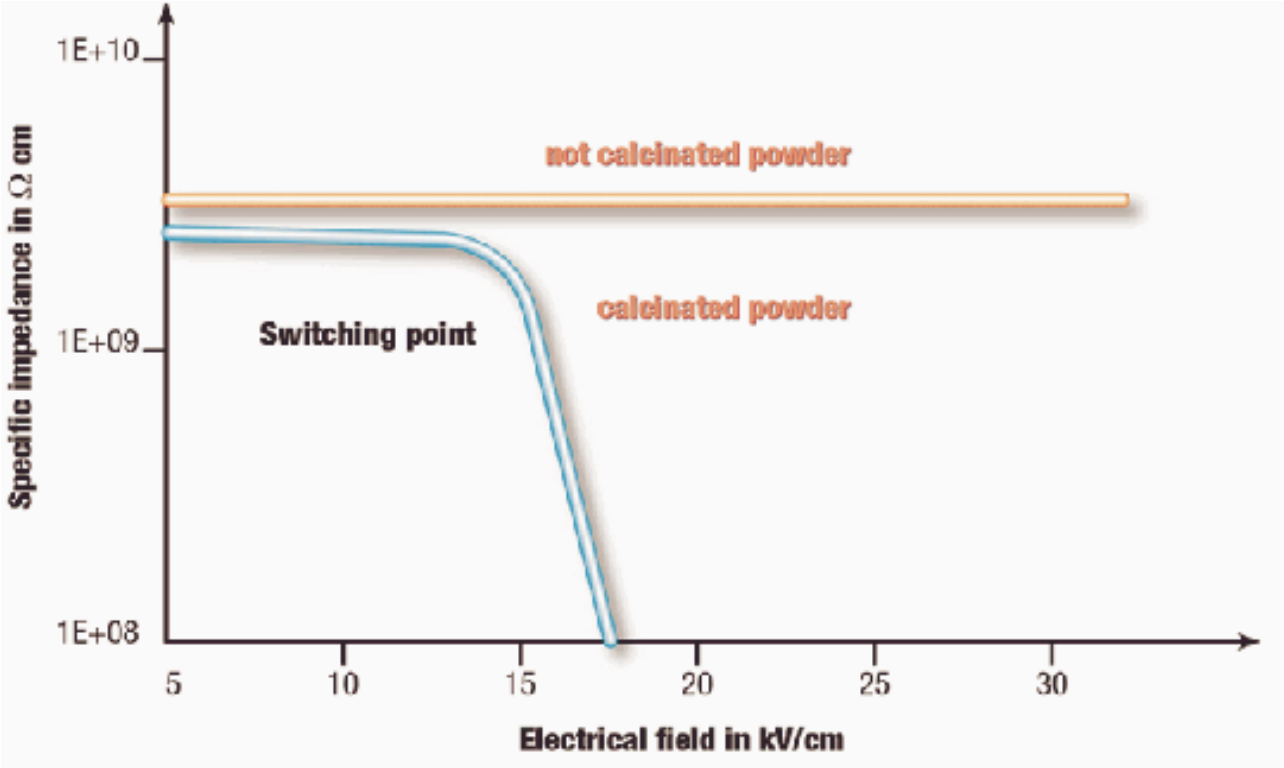
# ZnO - Model




# Equivalent Circuit

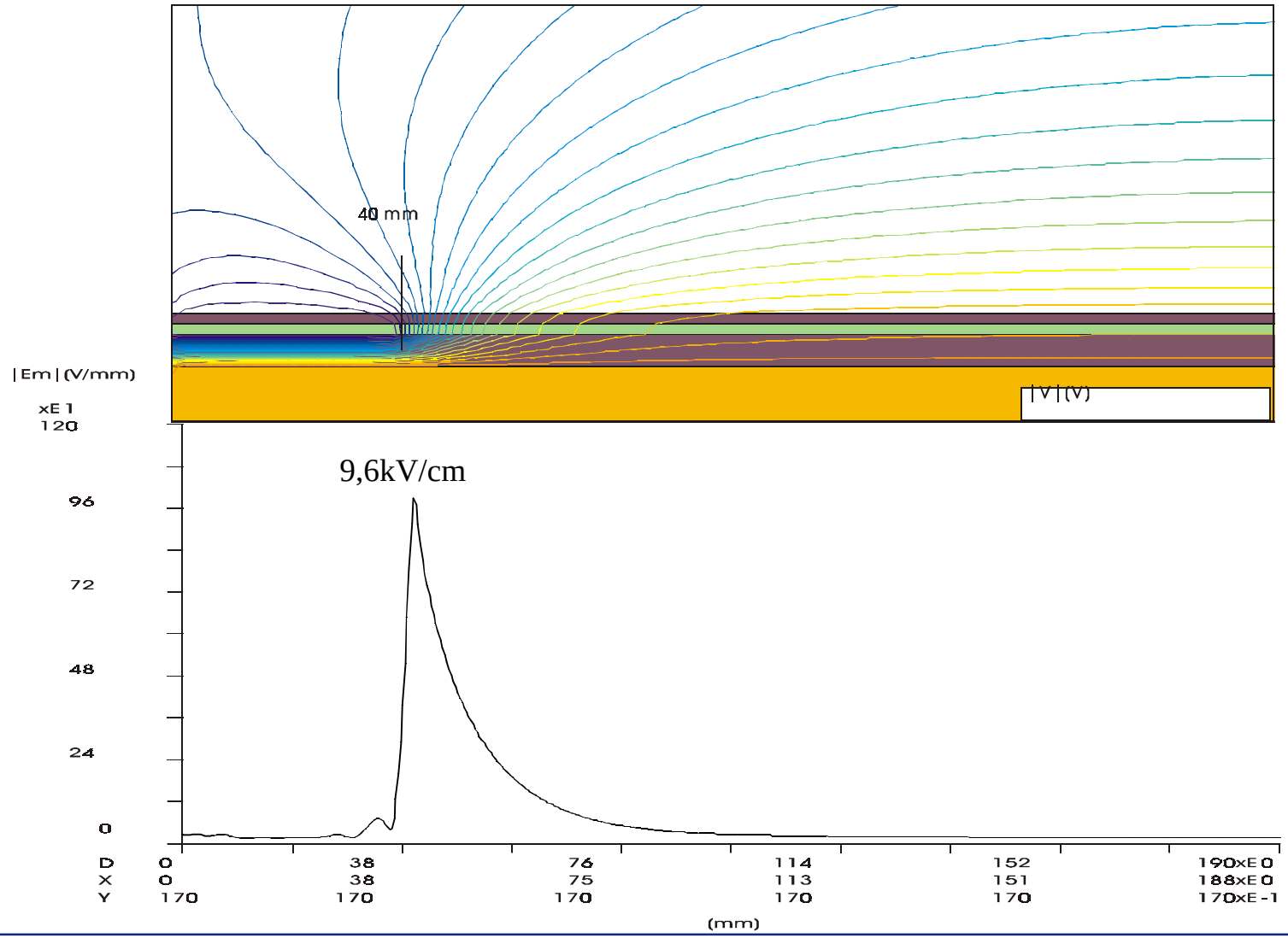


# ZnO Characteristic

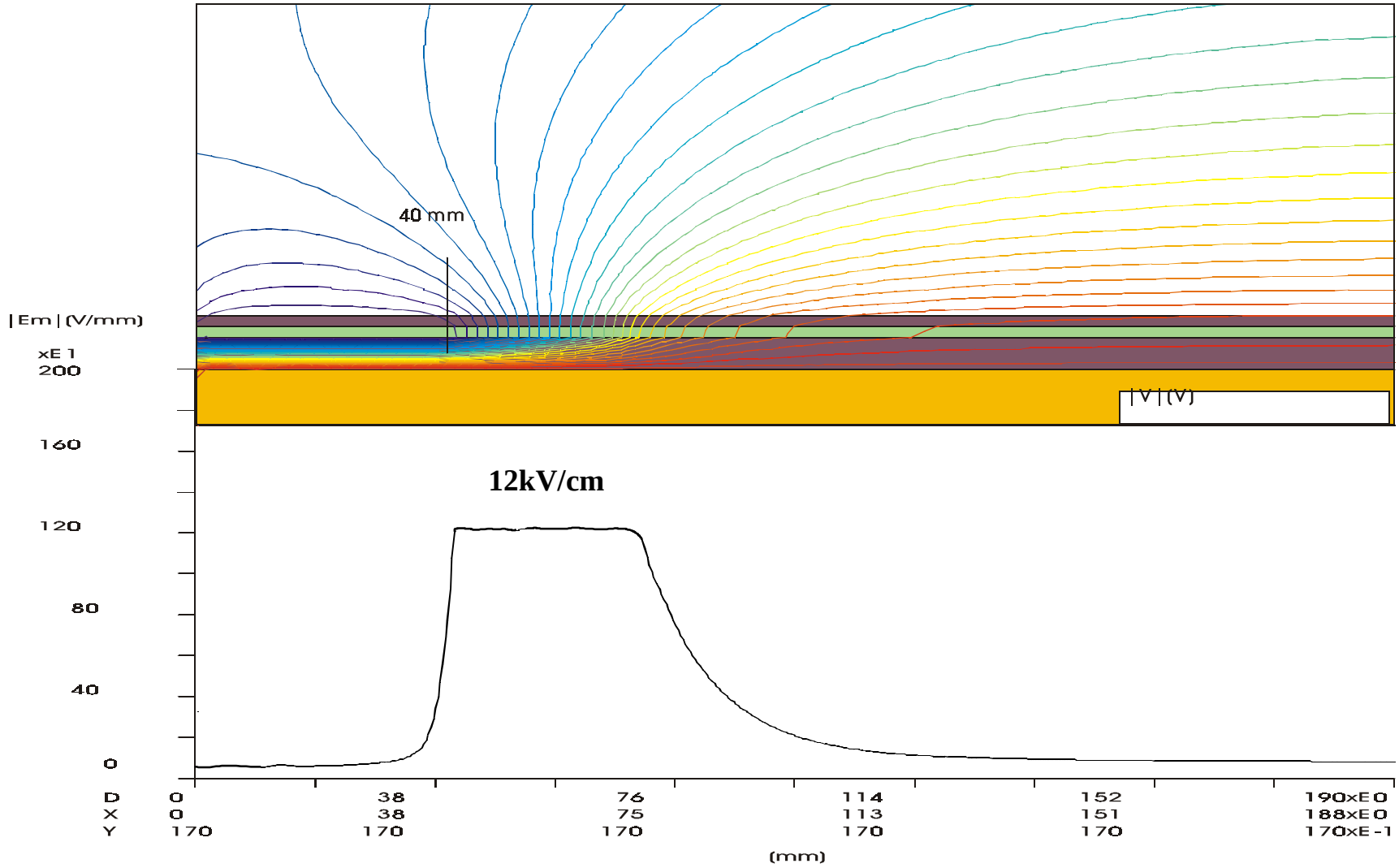



- Polymer matrix doped with ZnO powder
- Extreme non-linear stress control characteristic
- Switching point can be adapted as needed
- Excellent electrical performance, especially BIL

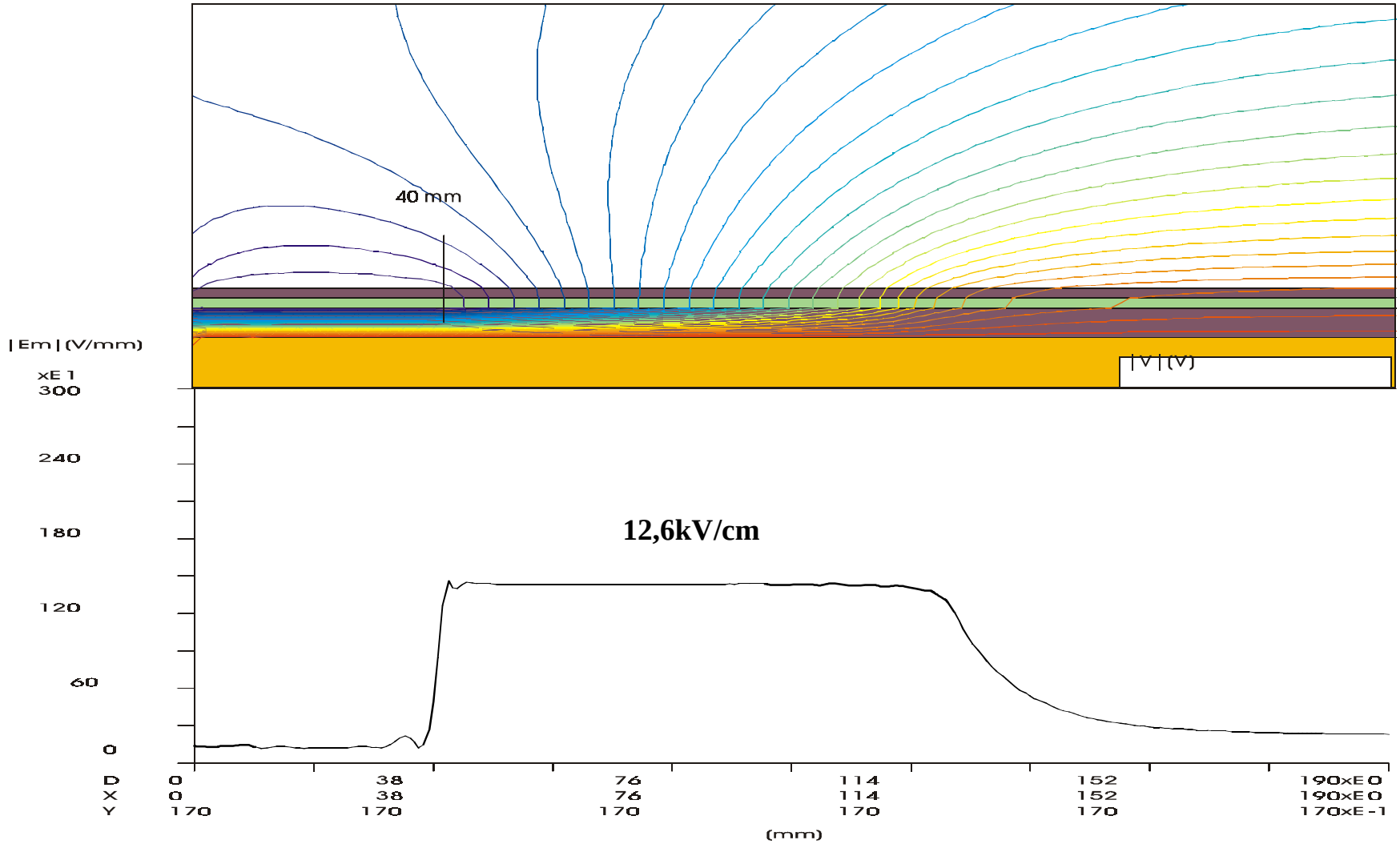
# Field distribution: 12kVph/earth



# Field distribution: AC withstand voltage 57kVph/earth

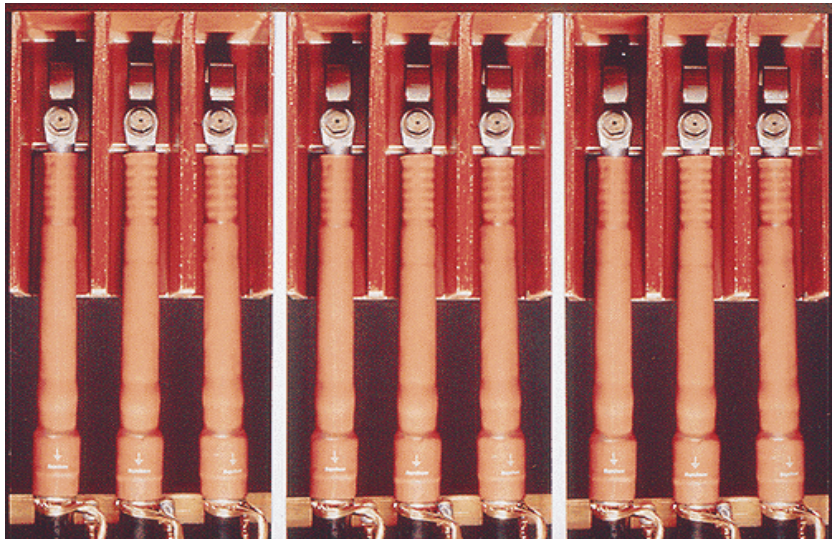


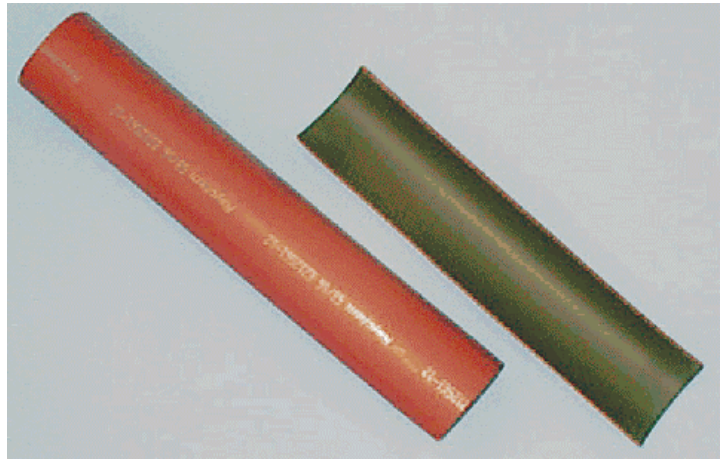
# Field distribution: BIL 150kV ph/earth



# Example: Co-extruded tubing

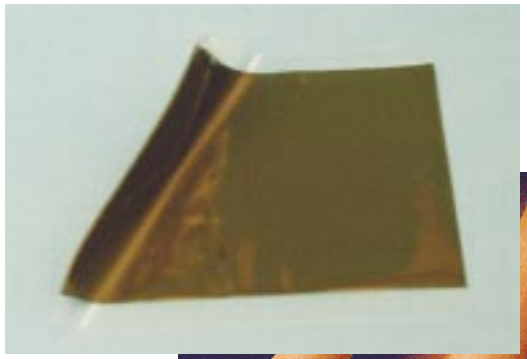
- Compact, slim and short
- Positioning insensitive
- Universal for all voltages
- Melts during installation, conforms to surface irregularities and seals
- Achieves BIL of more than 180kV for 24kV terminations

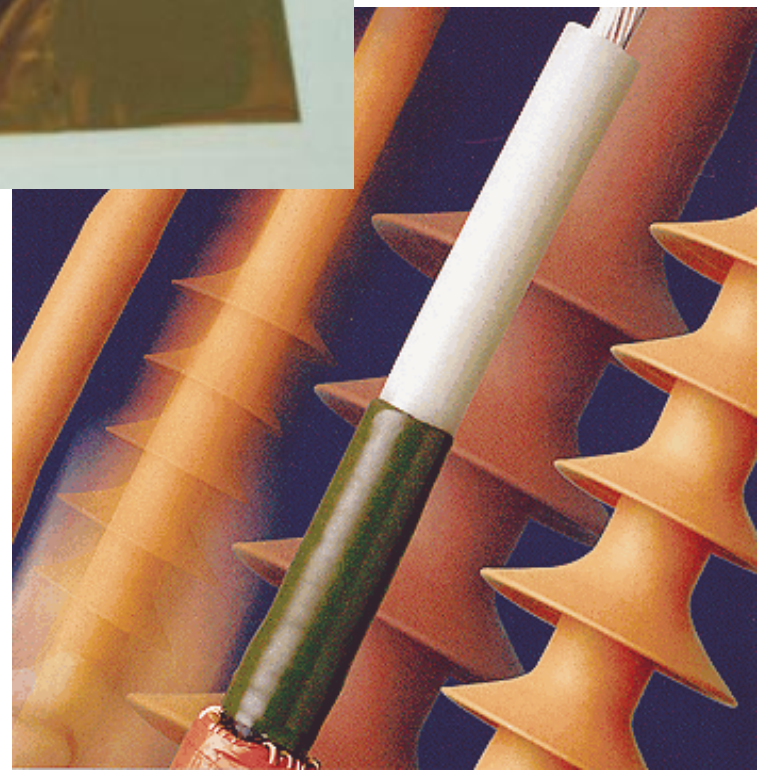




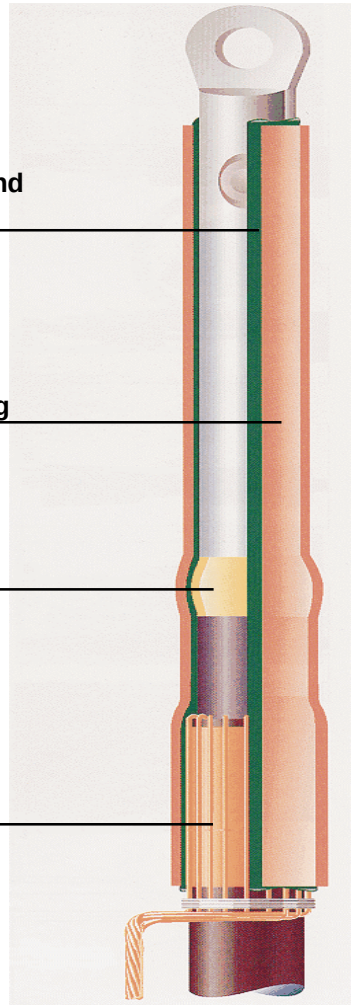
# Example: Patch, Mastic

- Conforms to insulation by pressure or heat
- Allows wide tolerances for thicknesses and overlap
- Simple installation and universal application
- Easy to adapt to variety of dimensions

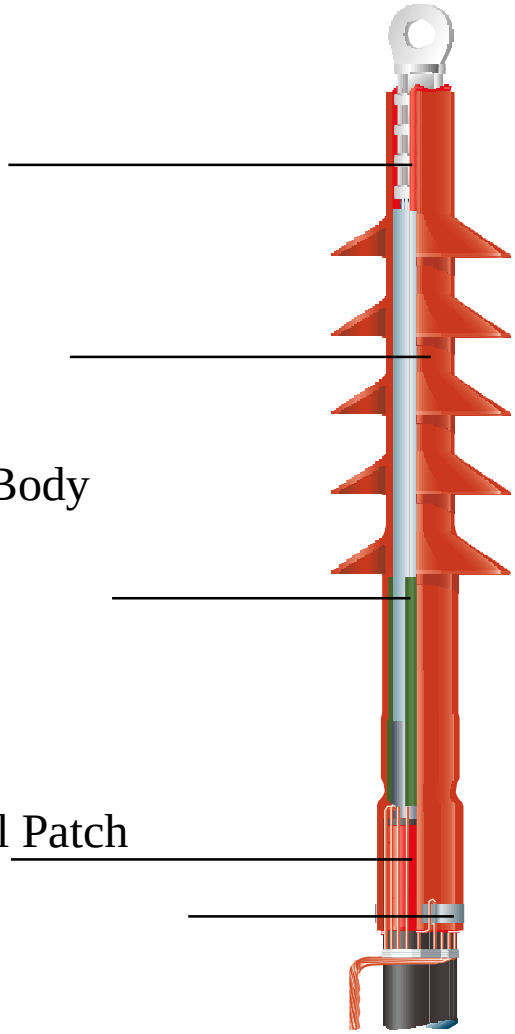




# IXSU-F - Design




# TFT - Design



# UniGrade - Universal Stress Control for the Future

- Well defined electrical characteristics
- Very high impulse withstand
- Ceramic, inert material
- Properties defined by particles, less sensitive to mixing
- Less complex and less costly manufacturing process
- Universal application: Voltage, cable, surfaces
- Versatile delivery form: Coating, co-extrusion, patch, molded part

# Summary

- Stress control systems based on materials technology have excellent properties
  - High BIL performance
  - High AC withstand performance
- Compact design
  - Integrated in Polymers und Elastomers
  - Reduced dimensions