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# **XLPE Material Selection Characteristics to Consider for HV and EHV Cables**

## **Subcommittee A Cable Construction & Design ICC Spring 2010 Meeting**

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# XLPE Usage for Underground HV and EHV is Growing

- Higher Demand for Electricity
  - Substitution of paper oil cables
- Less resistance than overhead lines
- Since 2000, specifications were approved for XLPE
  - ICEA S-108-720 and AEIC CS9 up to 345 kV
  - IEC 62067 specification up to 500 kV

# Advantages of XLPE Insulation

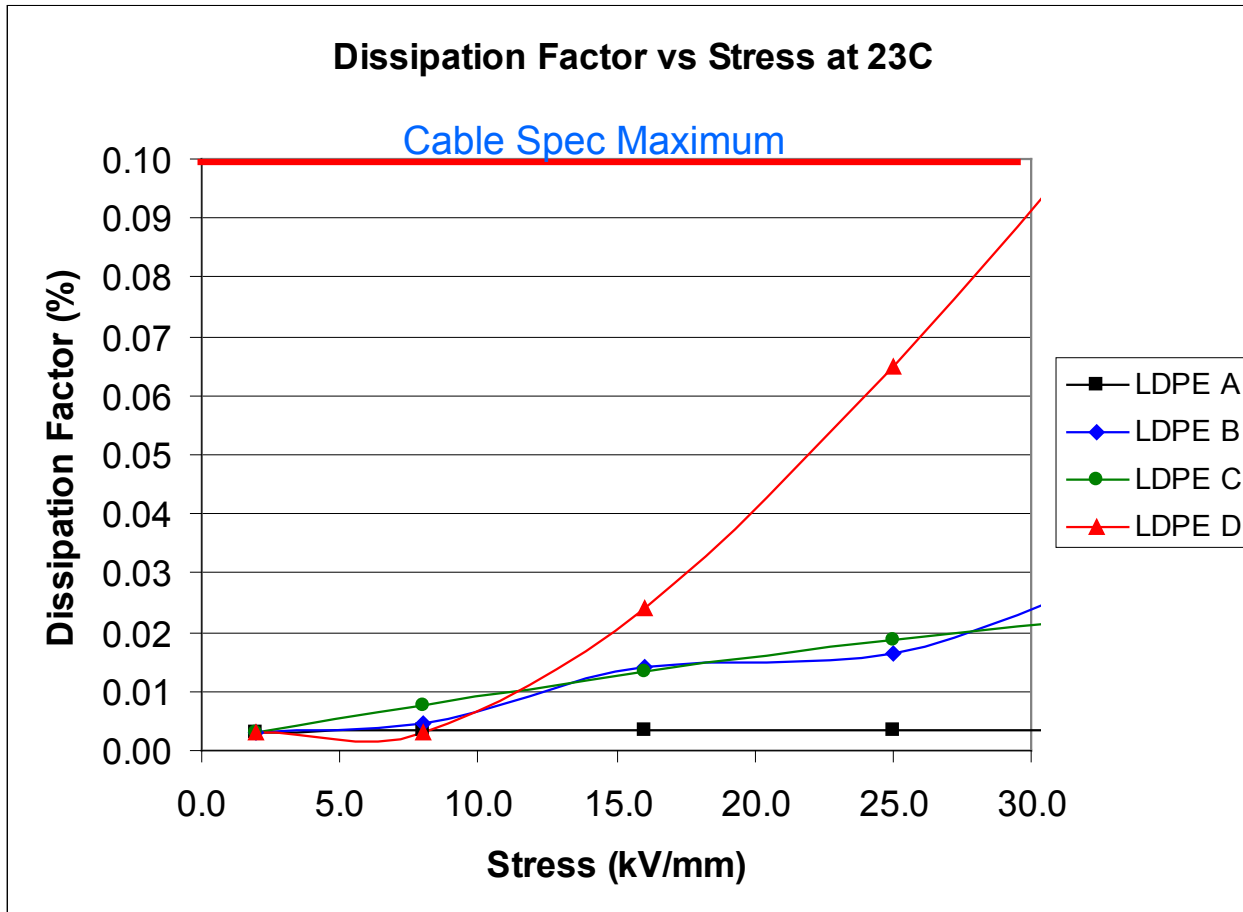
- Electrical & Technical
  - Very High Dielectric Strength
  - Very Low Dielectric Losses
  - Excellent Thermal and Mechanical Aging
  - Less Maintenance Than Oil Filled Cables
  - Easier Cable Handling
  
- Political, Social & Environmental
  - Environmentally Acceptable, Very Little Maintenance
  - No Oil Leakage Concerns
  - Less resistance than overhead lines
  - Aesthetics

# XLPE Material Selection Criteria

- Cleanliness
  
- Electrical
  - Dielectric strength
  - Dissipation factor
  
- Processability
  - Additive bloom/sweatout
  - Scorch retardance
  - Crosslinking characteristics
    - Moisture generation during the crosslinking process

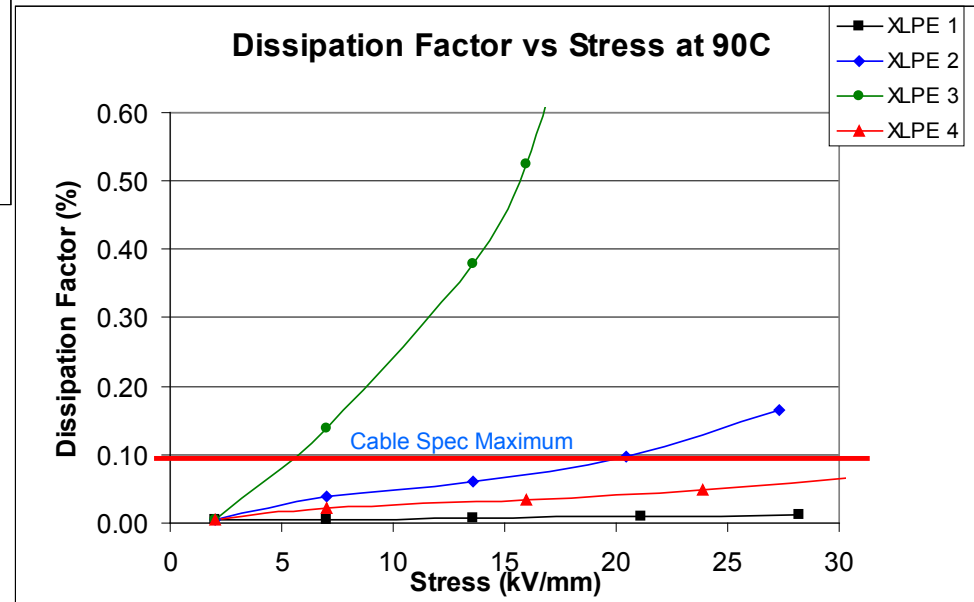
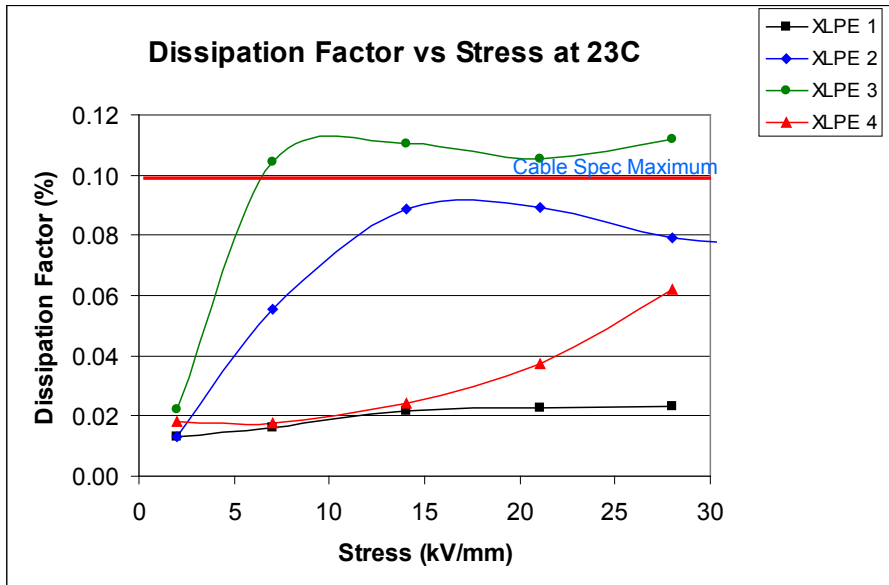
# Careful Selection of LPDE Base Resin

- Not all LDPE resins would be suitable for high stress applications



# Careful selection of Base Resin & XLPE Formulation

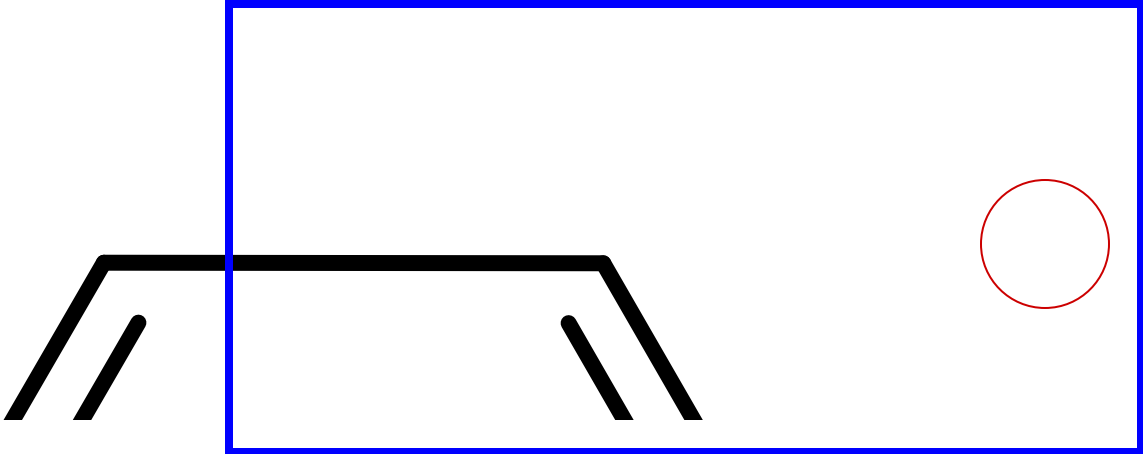
➤ Not all XLPEs would be suitable for high stress applications



# Crosslinking of Polyethylene with Peroxide “Ideal” Reaction

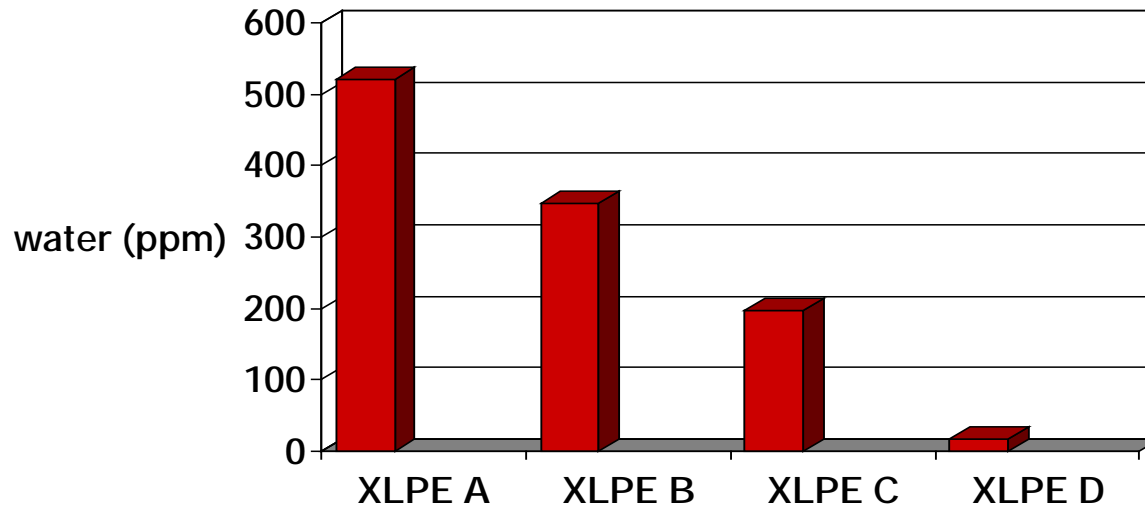


# Moisture Formed in Undesired Side Reaction During Crosslinking



# Moisture Generation During Crosslinking

- Comparison of 4 XLPE formulations



- Issues with excessive moisture generation during crosslinking:
  - May introduce voids in the insulation
  - Cable could have moisture induced electrical degradation

# In summary

XLPE for HV/EHV should be carefully selected based on several criteria, including....

- Cleanliness
- Dielectric properties
  - High dielectric strength
  - Low power factor at high temperature and stress
- Processability
  - Minimal “sweat out” or bloom of additives
  - High scorch retardance
  - Minimum moisture generation during cross linking