A Practical Superconducting Fault Current Limiter (0225)

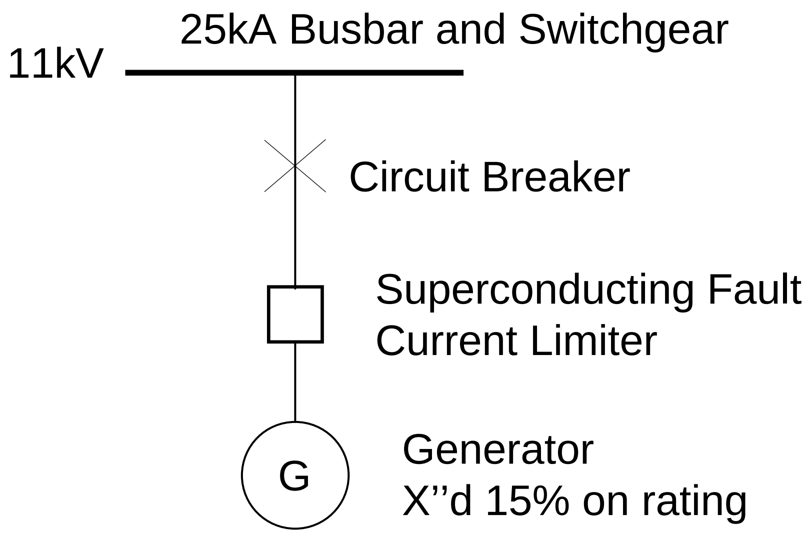
- Ideal characteristics-
  - Affordable, Reliable, Fail-safe
  - ‘Tuneable’ to specific application
  - Appropriate physical size / good neighbour
  - Capable of reducing ‘making peak’
    - (thus must be resistive)

Dr P D Hopewell, Rolls-Royce - UK

Why Do We Need SFCL?

- Fault levels are rising
  - New, local generation
  - Additional interconnection
- Upgrade or replace switchgear
  - To ensure safety
  - Costly…..can we delay / avoid?
- Non-conventional networks
  - Eg – ships with 10+MW at 1000V

SFCL – Simplified Example

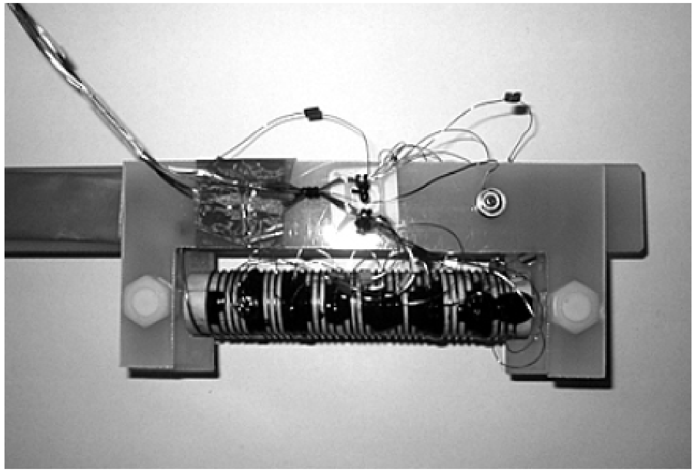


- Existing FL 20kA
  - Without SFCL – can only add 14MVA generator
  - With SFCL – can add 47MVA generator

Magnesium Diboride – An Ideal Material?

- Inexpensive superconductor
- First synthesised 1953
- Found superconducting 2001 (39K)
  - Requires advanced refrigerant technology
- More suited to SFCL than BSSCO / YBCO
  - Due to physical properties

MgB_2 Advantages

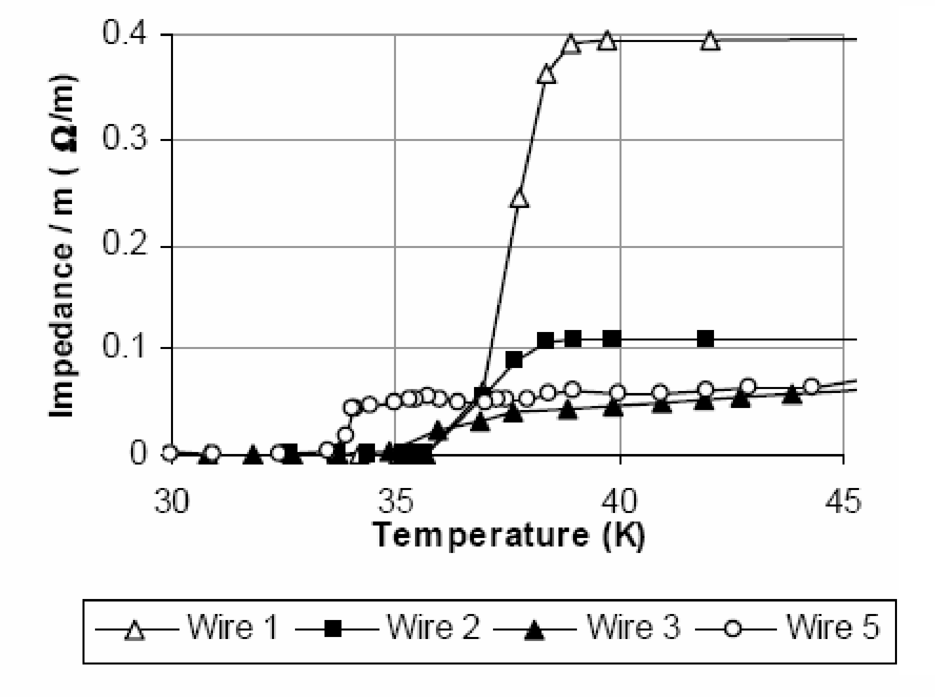


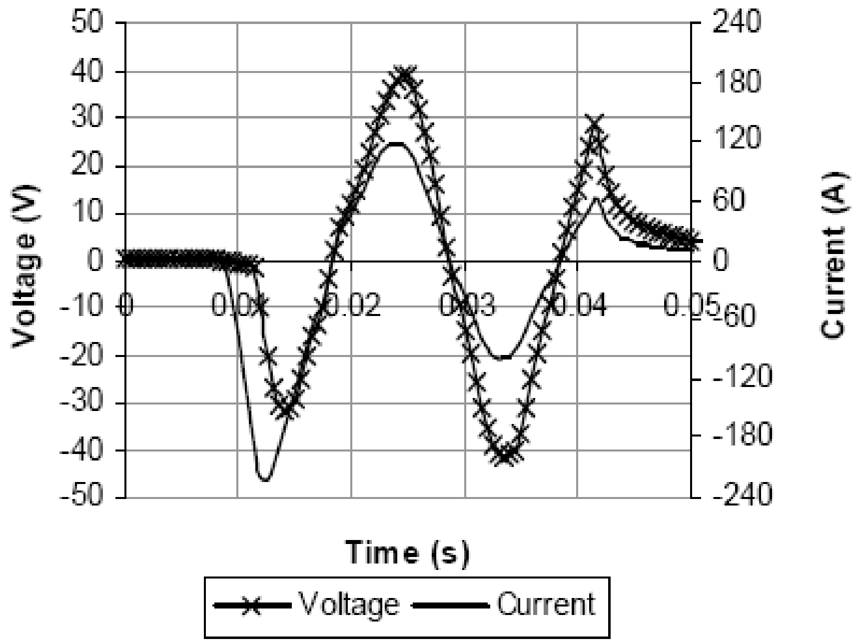
- Physically robust
  - Compact winding, resistant to thermal shock
- High resistance when non-superconducting
  - No external resistor necessary
- AC / DC operation
  - Grid / ship / aeroplane operation

SFCL Design Parameters

- Trip current
- Quench current
- Fault clearance time
- Recovery time

Trip and Quench Current Characteristics





Quench Response of MgB_2 Wire at 27K, with a Prospective Peak Current of 353A

Conclusions

- MgB_2 is highly promising SFCL material
- Cost-effective and robust
- Resistant to thermal shock and process handling
- Dependable and predictable quenching
- Tuneable for application