

Paris Session 2022



Superior Size Reduction Insulating Spacer for 245kV class GIS by FGM and Nanocomposite Material Technology.

SC D1 Materials and emerging test techniques
PS2/Q_2.09

Kenji Okamoto (Japan)



1. Question and our contribution

< Question >

Q PS2.09: Is the reduction in the number of contributions on nanocomposites a sign of waning interest, acceptance that bulk processing remains a significant challenge or a reflection that these materials are moving towards real-world deployment? How close is the industry to deployment of nanocomposites?

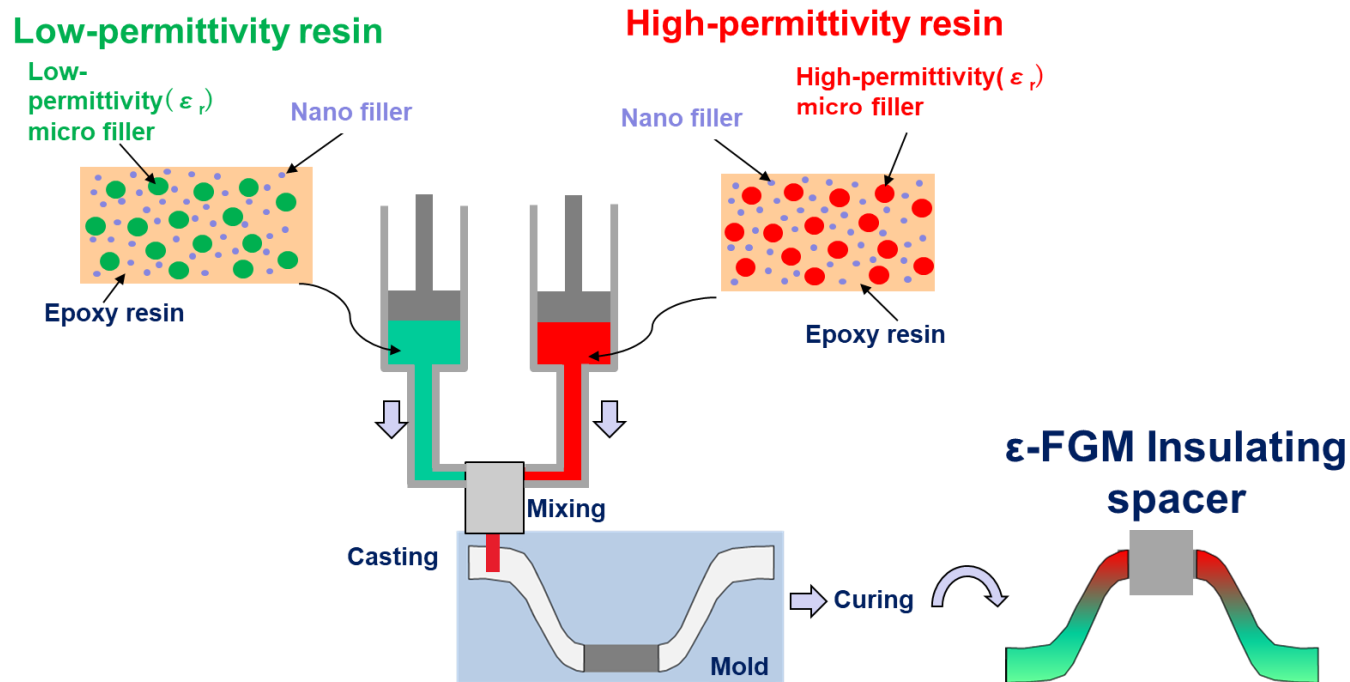
< Answer >

- The insulating spacers with a 30% smaller diameter for 245kV class GIS has been developed using the permittivity (ϵ) functionally graded materials (ϵ -FGM) and a nanocomposite materials. The application of these technology is highly effective for downsizing of GIS and GIL.
- Furthermore, when using an alternative gas such as dry air, which has lower insulation than SF₆, the application of FGM and nanocomposite material technology to GIS and GIL can suppress the increase of equipment size and gas pressure.

2. Introduction

R & D has been conducted to downsize insulating spacers with a **30% smaller diameter** using the latest functional insulating materials such as **permittivity (ϵ) functionally graded materials (ϵ -FGM)** and a **nanocomposite materials**.

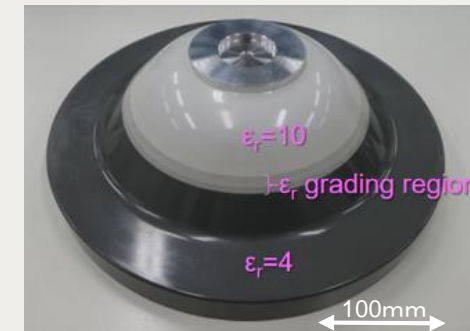
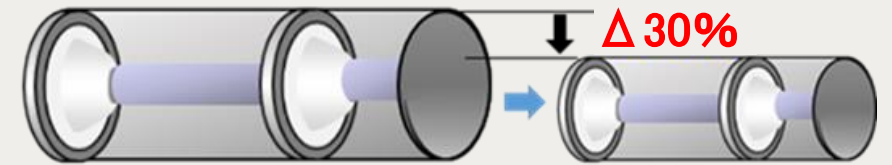
Concept of flexible mixture casting method for insulating spacer



Target of studies

Conventional GIS, GIL

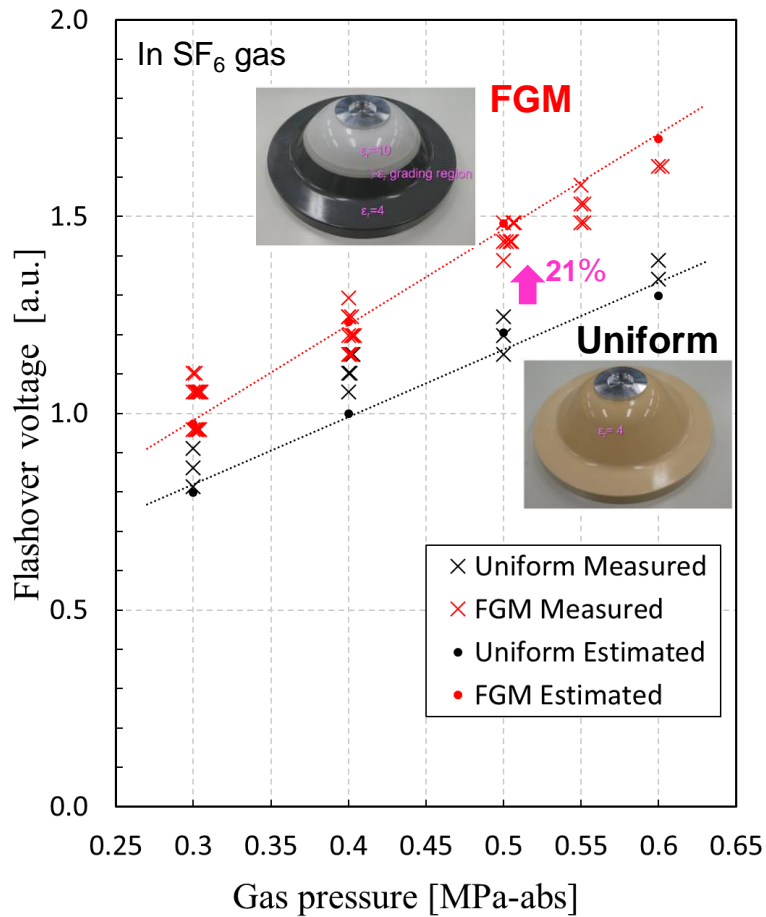
Target



Produced actual size 245kV class GIS insulating spacer with LIWV ± 1050 kV

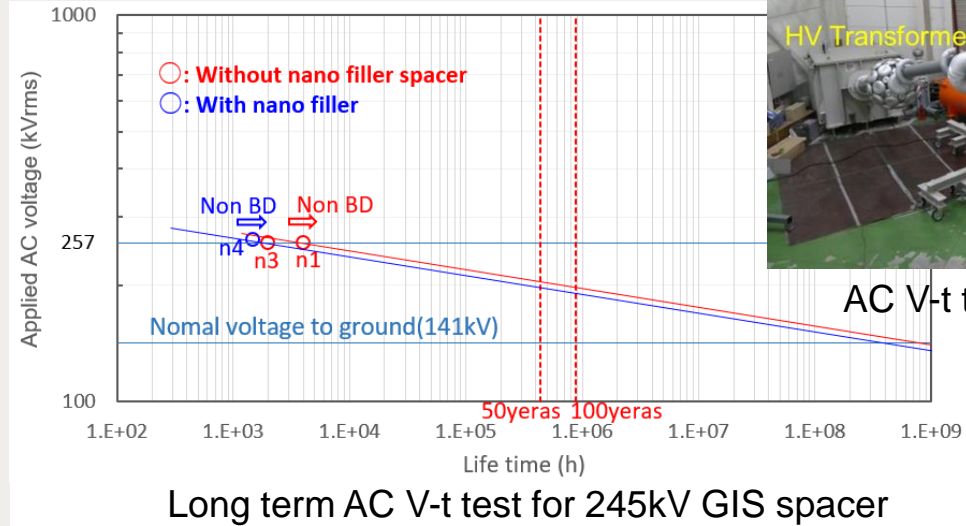
3. Details of the study

- LI voltage FOV: improved by 21%
- 15 times LI ± 1050 kV satisfied



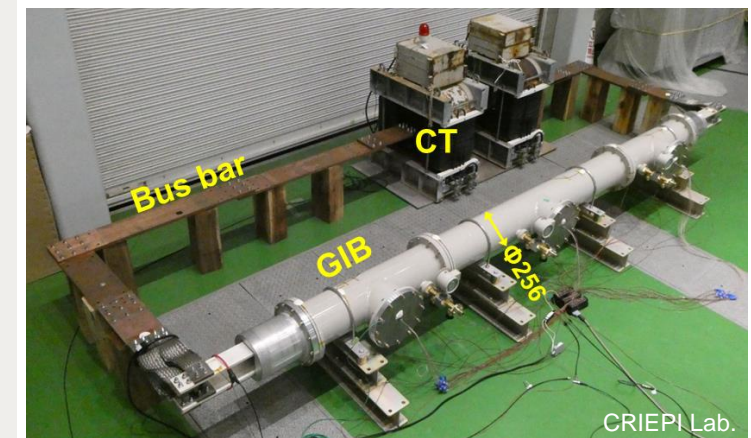
Test results of LI flashover voltage for uniform and ϵ -FGM spacer models.

- Long term AC V-t: ≥ 100 years
- Applied V=AC257kVrms



AC V-t test apparatus

- Temperature rise: < 75K
- Rated I=4000A



Temperature rise test of GIB

4. Conclusion

- The insulating spacers with a 30% smaller diameter for 245kV class GIS has been developed using the permittivity (ϵ) functionally graded materials (ϵ -FGM) and a nanocomposite materials. The application of the technology is highly effective for downsizing of GIS and GIL.
- Furthermore, when using an alternative gas such as dry air, which has lower insulation than SF₆, the application of FGM and nanocomposite material technology to GIS and GIL can suppress the increase of equipment size and gas pressure.

Thank you for your attention !