Paris Session 2022

Functionally Graded Materials (FGM) Application for Next Generation SF_6 Alternative GIS

SC B3 Substations and electrical installations

PS2/Q_PS2.2

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1. Question and our contribution

< Question>

Q PS2.2: Much development has taken place to reduce SF_6 impact on the environment from utility application for electrical insulating and interrupting equipment. What are likely to be the enduring initiatives to prevent SF_6 gas leaks and find a possible alternative to SF_6 for GIS applications?

< Answer >

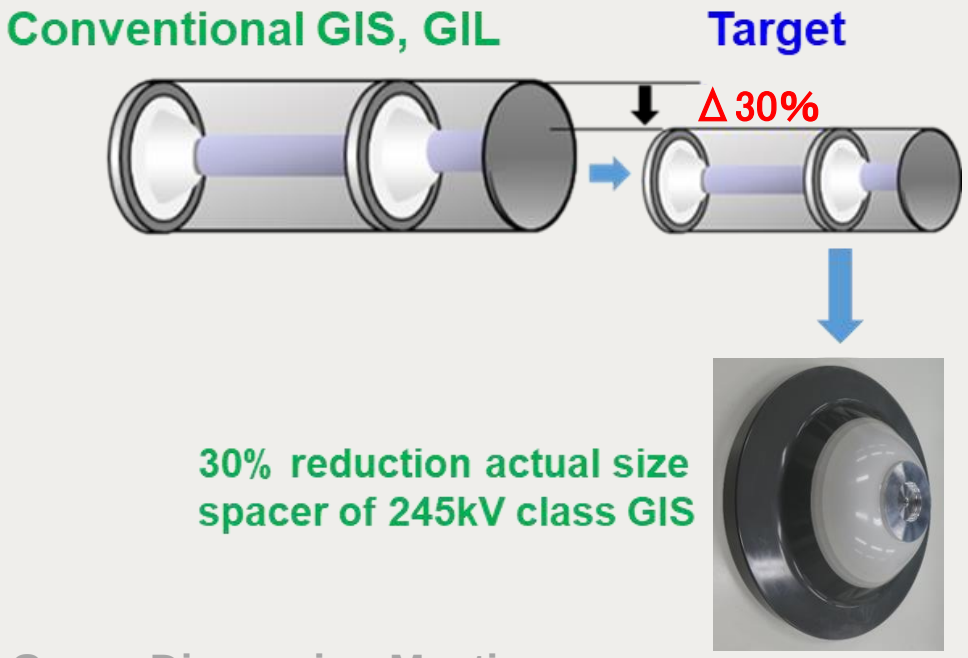
·The permittivity (ε) functionally graded materials(ε-FGM) insulating spacer for 245kV class GIS was developed which could reduce the GIS and GIL diameter by 30% from the conventional one.

·In the case of SF_6 alternative gas such as natural gas (dry air), by applying ε-FGM technology to GIS insulation spacer, it is possible to suppress the increase of insulation gap distance and gas pressure, and upsizing of equipment. In particular, it is expected to contribute to the replacement of narrow-area substations (Indoor, underground, mountain, offshore, etc.) that require the same scale.

2. Introduction

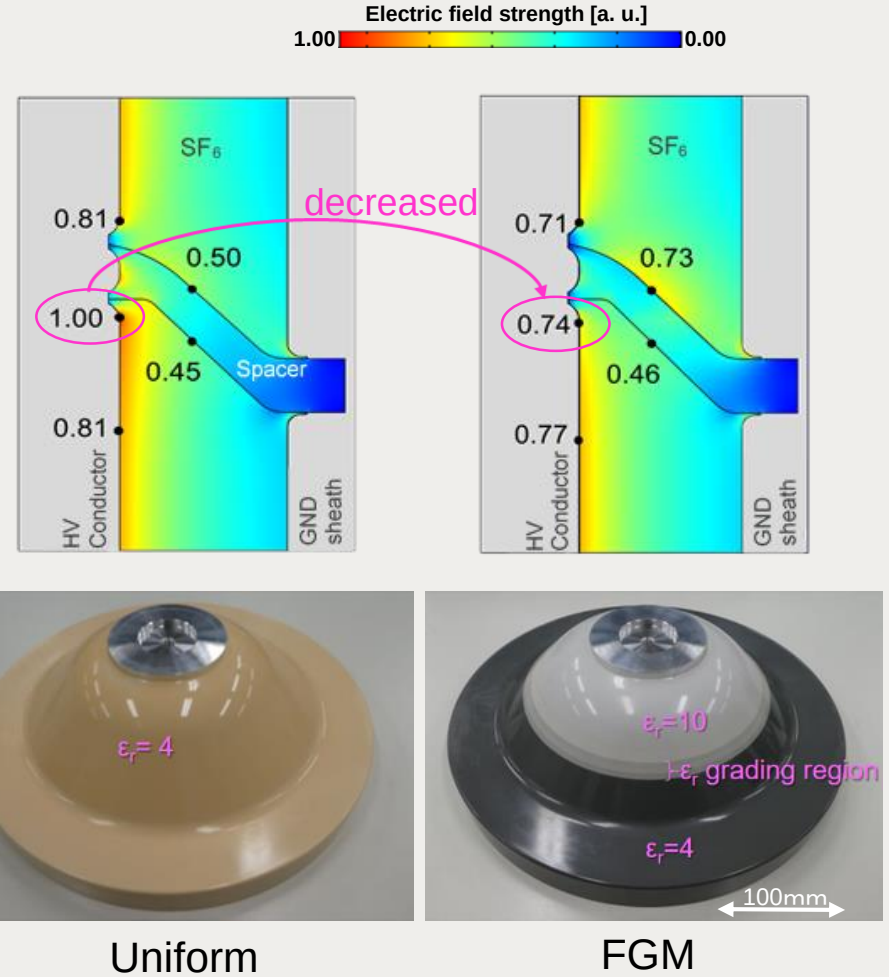
R & D has been conducted to downsize insulating spacers with a 30% smaller diameter using the permittivity (ε) functionally graded materials (ε-FGM).

Concept



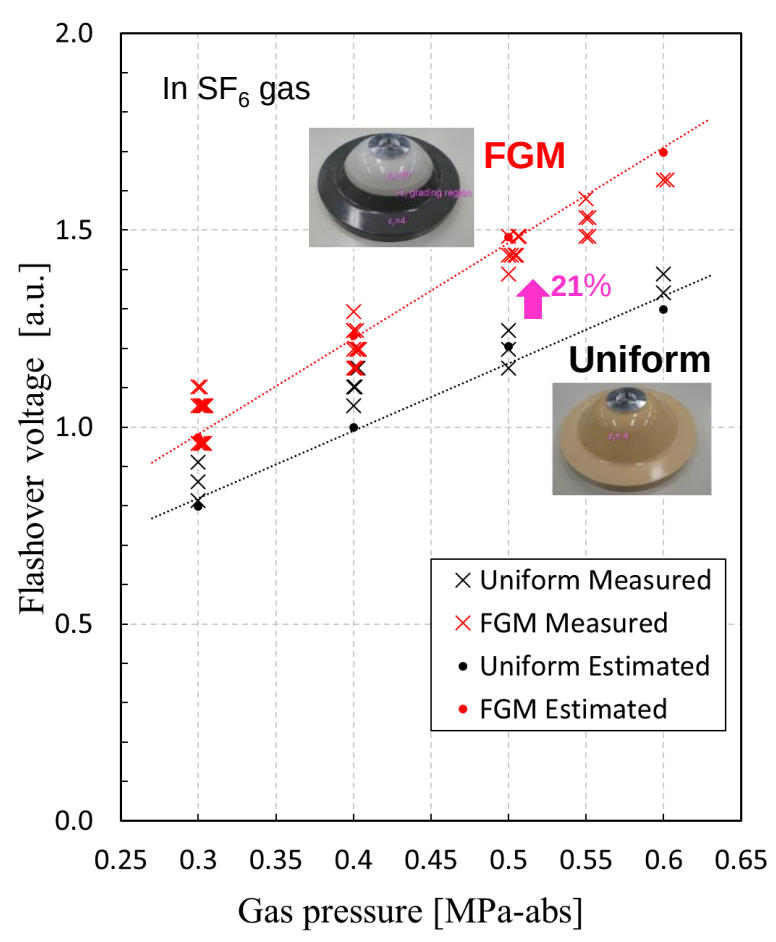
3. Details of the study

Calculated electric field distribution and fabricated actual size (245kV class GIS) cone-type spacer.



4. Conclusion

The FOV of the FGM spacer increased more than that of the uniform spacer with ε_r=4 under a negative standard LI voltage in SF_6 gas, and the average FOV was improved by 21% at 0.5 MPa-abs.



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In the case of using SF_6 gas, the consumption can be reduced by further downsizing of the GIS.

Example of a narrow GIS substation

Thank you for your attention !