가스절연기기의 부분방전검출을 위한 SWNT-UHF 융합센서

SWNT-UHF Fusion Sensor for GIS Partial Discharge Detection

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Abstract : To detect the PD events, we have studied a fusion sensor, the UHF sensor and the single-walled carbon nanotube(SWNT) gas sensor. We are accustomed to the UHF sensor which have employed to detect the partial discharges in apparatus GIS-like. But the SWNT gas sense is a newly way proposed to detect the partial discharges. In this study, we monitored not only the changes of the electrical conductance of the SWNT sensors in responding to the PD events but also the signal of the UHF sensor at the same time with IEC 60270 standard method for reference on the partial discharge events.

Key Words : GIS, SWNT Sensor, Partial Discharge, UHF

1. INTRODUCTION

The PD detection method with CNT (carbon nanotube) has some advantages over the other types of the PD sensor. For example, it is less influenced by background electromagnetic or acoustic noises, and can be applicable to both of on-line and off-line PD monitoring. In this paper, we have proposed and discussed a novel sensor which assembled the SWNT(single-walled carbon nanotube) gas sensor and UHF sensor installed in the GIS mock-up filled in SF6 gas.

2. EXPERIMENTAL RESULTS AND DISCUSSION

We fabricated a prototype fusion sensor which assembled the SWNT gas sensor and the UHF sensor to detect the PD events. We applied 5 kV for generating PD as 10 pC, for 20 pC we increased the applied voltage up to 7 kV. When the discharge amount changes from10 pC to 20 pC, increased twice, the applied voltage was increased about 1.4 times. Therefore the PD energy increments are 2.8 times and the output variations of the TE571 PD sensor are about 1.6 times, in the case of the UHF sensor is about 2 times, while the SWNT gas sensor is about 5.8 times. We did not calculate the exact energy but it is not a problem because we just used the variation of the energy calculated like applied voltage approximately multiplied by the appearance charge. This is not to know the exact PD energy but to simply compare between each sensors and the variation of the energy. It is also correlated with the averaged energy displayed from the TE571.

The results of detecting PD events using the SWNT-UHF fusion sensor suggested from this study. It is an accumulated data, but very small in size composed of several hundreds of bites changing its conductance due to the interaction with SWNT sensor and gas molecules produced in the GIS mock-up while generating PD events. From the results, the data which acquired different sensor using the SWNT-UHF fusion sensor have a complementary meaning to each other; it is available to acquire the good data with the fusion sensor better than the conventional sensors used alone such as UHF sensor or other gas sensors.

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References

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