DEVELOPMENT OF EXTERNAL DIAGNOSIS FOR XLPE CABLE TERMINATIONS

Hiroshi **SUYAMA**, Takaharu **KOHAMA**, Yukinobu **MORISHITA**, Chubu Electric Power Co., Inc., (Japan), Suyama.Hiroshi@chuden.co.jp, Morishita.Yukinobu@chuden.co.jp, Kohama.Takaharu@chuden.co.jp

Etsuro **SATO**, Tadanori **NAGAYAMA**, Tohoku Electric Power Co., Inc., (Japan), sato.etsuro.ny@tohoku-epco.co.jp, nagayama.tadanori.ef@tohoku-epco.co.jp

Kazutoshi **ABE**, Hiroshi **SUZUKI**, J-Power Systems Corp., (Japan), abe.kazutoshi@jpowers.co.jp, suzuki.hirosi@jpowers.co.jp

ABSTRACT

Authors are studying an external diagnosis method for terminals of XLPE cables by discharge product gases as indicators, focusing especially on acetylene, a characteristic gas that is produced by discharging.

A gas analysis of the air in the lower metal casing and a disassembly investigation of it are performed on aged terminals of XLPE cables. After studying the relation between the results of the analysis and the investigations, a good prospect for external diagnosis method by acetylene analysis for aged terminals excluding some manufactures' products was obtained.

KEYWORDS

XLPE cable; Terminations; Acetylene; Gas analysis; Partial discharge; External diagnosis.

INTRODUCTION

As XLPE cables have increased in their numbers, a highly accurate deterioration diagnosis technology is desired to improve the reliability of them. A deterioration diagnosis method for water-trees of XLPE cables, which is the main cause for insulation deterioration, was developed and applied to actual cables. However, the deterioration mode of terminations has not yet been clarified, thus no deterioration diagnosis method for them had been established [1].

From the results of partial discharge tests on sheets embedded with voids, authors are looking at acetylene as a characteristic gas that is produced by discharge. A gas analysis of the air in the lower metal casing of XLPE cable terminations presented a good prospect for applying acetylene gas analysis to external diagnosis of the terminations [2-4]. In addition, acetylene gas analyses and disassembly investigations were performed on many aged 66 and 77kV XLPE cable terminations, and then the relations between the results of the analyses and the investigations were studied. As a result, they produced a good prospect for aged terminations of actual cables [5-8].

DETERIORATION CAUSES AND SIGNALS OF TERMINATIONS

As a main cause for XLPE termination deteriorations, there is the discharge on the interface between EPR and Epoxy (or XLPE) inside the terminations, thus making us take note of a gas in the air (acetylene) as a deterioration signal that relates with the discharge inside the terminations.

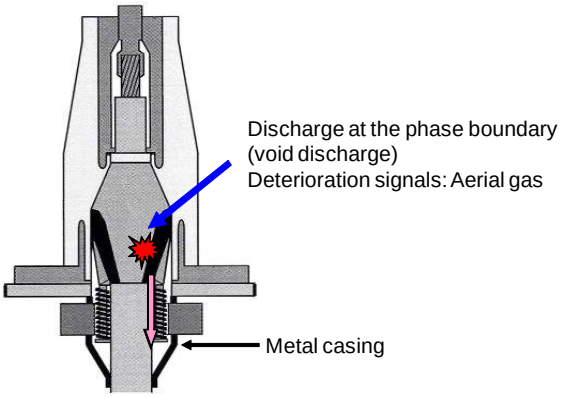

Fig. 1: Deterioration cause and signal of terminations

FUNDAMENTAL EXPERIMENTS

Some gases are produced not only by partial discharge but by spontaneous emission from termination materials. Since it is important to judge whether detected gases were produced by partial discharge or not, fundamental experiments were performed before investigation into aged terminations on site.

Experiment to detect discharge product gases on interfaces of terminations

As for the gases that are produced by partial discharges on interfaces of XLPE cable terminations (epoxy/EPR, XLPE/EPR), an experiment was performed on sheet materials.

Experiment method

Materials: A combination of EPR, XLPE, and Epoxy sheet (of 1mm thickness each), Silicone applied on the surface of EPR (Tab. 1)
Mimic void: Void (of 10mm diameter at the center of the sheet)
Electrical charge: Around AC 7kV/2weeks and non-charge
Temperature: Normal (60°C for non-charge material)
Measurement items: Gas concentration in the air of test chamber and partial discharge
Analyzed gases: 13 kinds of gases including acetylene and ethylene

No	Specimen	Silicone Oil	Voltage (Temperature)
1	XLPE + EPR	Coated	Applied (Room temperature)
2	Epoxy+ EPR	Coated	Applied (Room temperature)
3	Epoxy + XLPE + EPR	Coated	Not applied (60 °C)

Tab. 1: Test materials