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COUNTRY : JAPAN PREF. SUBJECT :PS1
REGISTRATION NUMBER : 7302 QUESTION N° : 1.12

B2_PS1_Q1.12_Y. Okawa

Question 1.12: Would the experts from other countries/utilities share their experience in use of RTV coated insulators in heavy polluted areas and ageing over the years?

Contribution for Q1.12:

Field Experiences of RTV Coated Insulators in Heavy Polluted Areas

1. Introduction

This contribution describes the satisfactory level of field performance of RTV coated insulators removed from two types of heavy polluted areas in Middle East and Japan was observed. In addition, new verification test for anti-ageing performance is proposed, and the proposed acceralated ageing test in CIGRE TB 837[1] is additionally discussed.

2.1 Experience in Middle East

RTV coated long rod insulators were exposed under very heavy polluted area (categorized as per IEC 60815-1) combined with sea salt and desert soils for 5 years in 380 kV line. Surface deterioration such as erosion can be observed on the part of the surface, especially trunk portion as shown in Fig. 1. Nitric acid was appeared on it. FT-IR (Fourier Transform Infrared Spectroscopy) spectrum of the RTV rubber on erosion portion is shown in Fig.2. However, significant higher fog flashover voltage than operational voltage can be obtained by laboratory test. On the other hand, the flashover voltage would be decreased with time.

Fig. 1 Removed RTV long rod insulators for 5 years

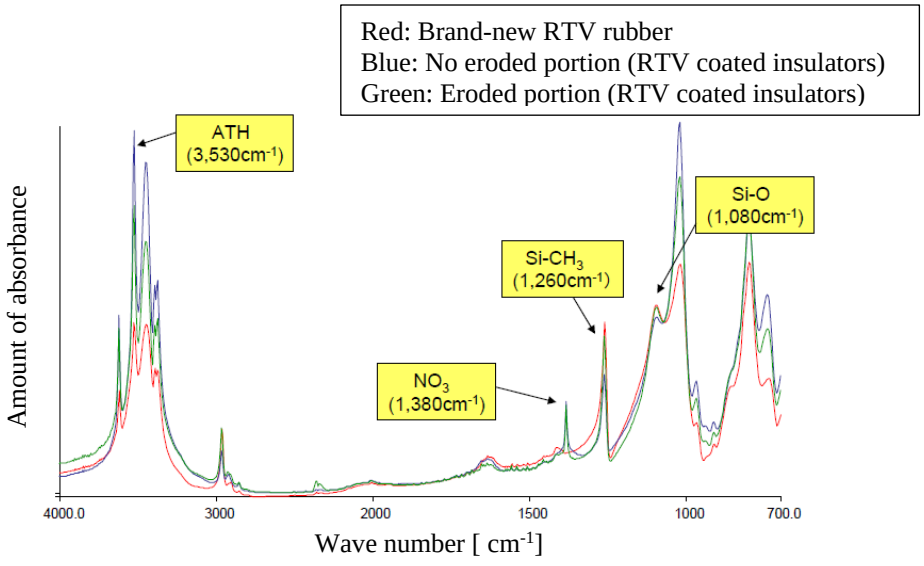
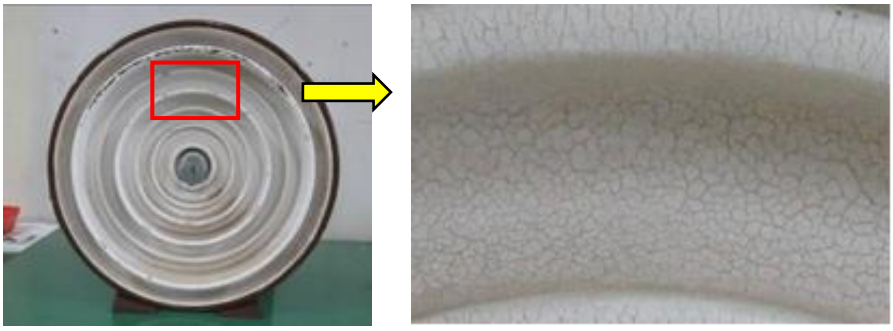


Fig. 2 FT-IR spectrum results

2.2 Experience in Japan

RTV coated cap and pin insulators were exposed under heavy pollution condition (Designed ESDD of 0.375 mg/cm^2) with sea salt for 10 years in ±250 kV line. Slight rough surface was observed as shown in Fig. 3. However, no erosion and excellent hydrohobisity was appeared. No significant pollution events have been reported even now.

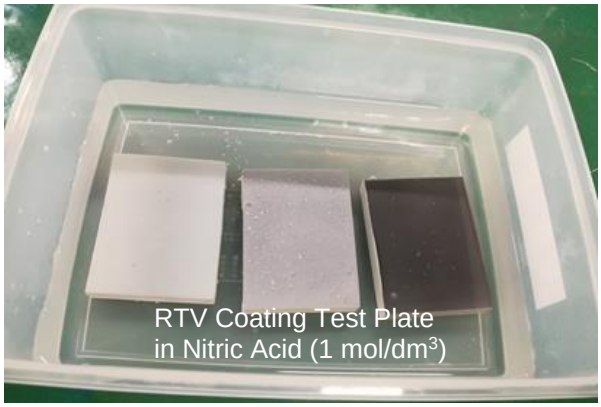


(Left side) Bottom surface of the insulator, (Right side) Slight rough surface observed, enlargement of left frame
Fig. 3 Removed RTV cap and pin insulators for 10 years

Fig. 4 Maintained hydrophobicity

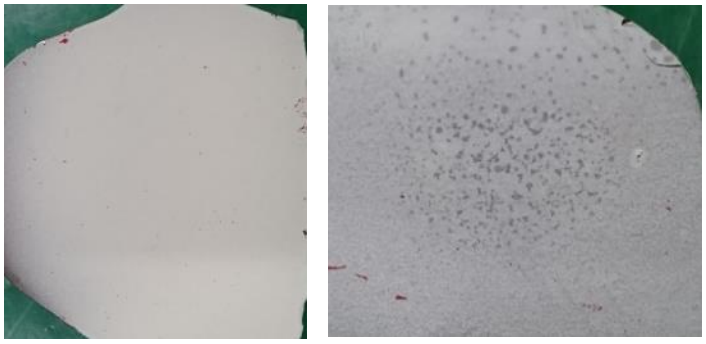
3. Proposed verification test (Nitric acid immersion)

It is found that the nitric acid generated by partial arc discharges under heavy pollution and high humid condition conditions causes deterioration of the eroded surface described on the above. Therefore, acid resistivity of the rubber (i.e. discharge resistivity) is one of important factors. Then nitric acid immersion test as shown in Fig. 5 was carried out as 1 mol/dm^3, because the lowest pH of the water drops on the surface subjected to corona discharges was zero, for high and poor quality RTV rubber. Fig. 6 shows the results of nitric acid immersion test. Nitric acid immersion test is recommended to discriminate high quality RTV silicone rubbers.



(Left side) High quality RTV, (Middle) Poor quality RTV, (Right side) Non-coated RTV
Fig. 5 Nitric acid immersion test

Before



Aftre 500 hours

(Left side) High quality, no change, (Right side) Poor quality, coating peeled

Fig. 6 Nitric acid immersion test results

4. Additional discussion

Acceralated ageing test (ie, the 2000-hour test) for RTV coated insulators is described in CIGRE TB 837[1]. This test procedure seemed not to simulate such specific very heavy pollution areas, also it is very complicated test. In addition, why the energized condition does not continue for full testing periods. The above proposed test can be carried out in a short time, and also it is very simple and effective.

Reference

[1] CIGRE Technical Brochure 837, “Coating for improvement of electrical performance of outdoor insulators under pollution conditions“, 2021.