Reduction Method of Audible Noise from HVAC Transmission Lines – Development of Weatherproof Low-Noise Spiral Wires –

Background

Two types of sound noise are sometimes generated from high-voltage AC overhead transmission lines. One is "audible noise" caused by corona discharge; the other is "aeolian noise" that is generated under strong-wind conditions. Thin spiral wires are twisted around the conductor of HVAC transmission lines to reduce aeolian noise. The spiral wire easily accumulates rainwater, therefore the overhead transmission line with spiral wires have many waterdrops that become the source of corona discharge in rainy conditions. At CRIEPI, it was clarified that a super-hydrophilic spiral wire produced by plasma thermal spraying of TiO_2 could reduce audible noise, because it had characteristics that caused water to be quickly exhausted. However, it was also clarified that the super-hydrophilic spiral wire with an aluminum substrate is easily deteriorated.

Objectives

The purpose of this study is to develop a weatherproof spiral wire that decreases both audible noise and aeolian noise (hereafter, low-noise spiral wire).

Principal Results

1. Audible noise reduction effect of low-noise spiral wires

It was clarified that the level of audible noise from low-noise spiral wires was lower than that from conventional spiral wires on the basis of full-scale corona examinations with artificial rain. The audible noise reduction effect of the low-noise spiral wire was excellent particularly for hum noise, which is less than that in not only conventional spiral wires but also in conductors that were not twisted with spiral wire (refer to Fig. 1).

2. Selection of substrate material and mechanical characteristics of prototype spiral wire

A low-noise spiral wire was made of a light titanium pipe to achieve weatherproof characteristics. The spiral wire has mechanical characteristics similar to those of the conventional spiral wire made of aluminum (refer to Table 1).

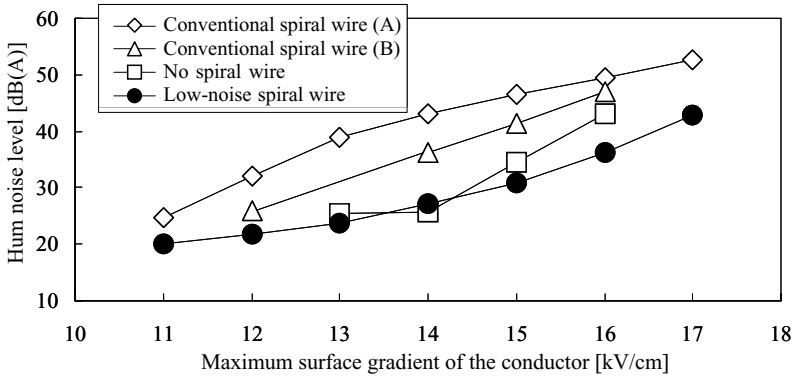
3. Evaluation of weatherproof characteristic by atmospheric corrosion test

Two types of low-noise spiral wire, made of a conventional aluminum rod and a titanium pipe produced by plasma thermal spraying TiO_2, were exposed outdoors for 234 days (refer to Fig. 2). The aluminum substrate and nickel intermediate were eluted on to the surface of the exposed low-noise spiral wire made of aluminum. However, there was no change in the surface of the exposed low-noise spiral wire made of titanium (refer to Fig. 3). Thus, a weatherproof spiral wire can be realized by using a titanium pipe as the substrate of spiral wires.

Main Researcher: Kiyotomi Miyajima,
Research Scientist, High Voltages & Electromagnetic Environment Sector, Electric Power Engineering Research Laboratory

Reference

K. Miyajima, et.al., 2008, "Development of Low-noise Spiral-Wires for HVAC Transmission Lines and Evaluation of Weather-Proof Characteristics", CRIEPI Report H07007 (in Japanese)



Above 10dB, the hum noise level of the low-noise spiral wire is lower than those of the two types of conventional spiral wires. (When four conductor bundles of ACSR410mm^2 are used as 500kV HVAC overhead transmission lines, the typical maximum surface gradient of the conductor level is about 15kV/cm.)

Fig.1 C omparison of hum noise level

Table 1 Mechanical characteristics of prototype spiral wire

Substrate material	Length [mm]	Diameter [mm]	Thickness [mm]	Weight [g]	Remarks
Aluminum (Conventional)	2554	6	Solid	206	-
Titanium	1834	6	1	138	Good construction

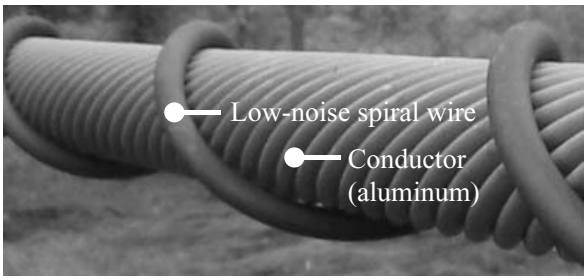


Fig.2 Low-noise spiral wire on titanium substrate

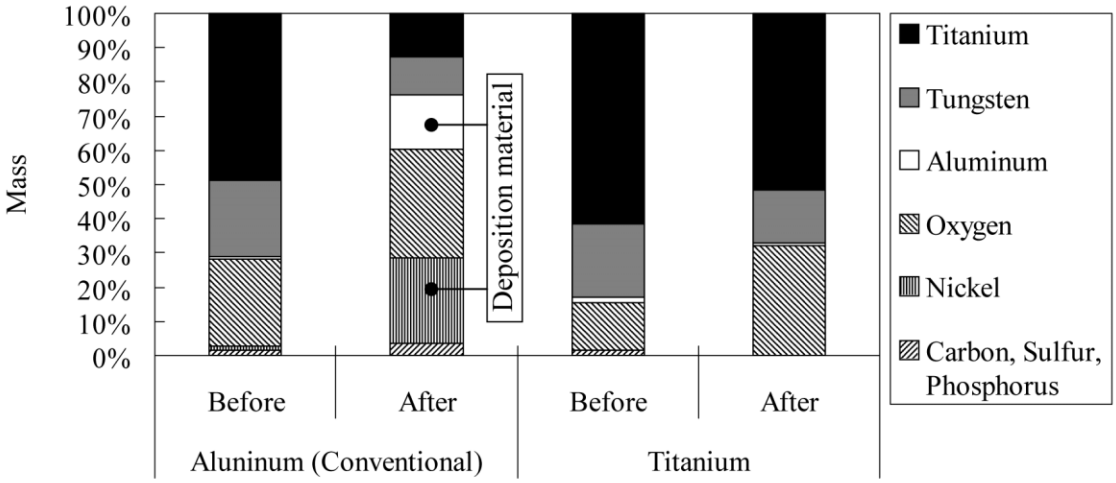


Fig.3 Proportions of component elements of surface (obtained using energy dispersive X-ray spectrometer)