Morphology and FT-IR analysis of anti-pollution flashover coatings with adding nano SiO2 particles

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Abstract. By adding nano SiO2 particles, an enhanced K-PRTV anti-pollution flashover coating had been prepared. Optical profile meter (GT-K), atomic force microscopy (AFM), infrared spectrometer (FT-IR) and EDS characterization were carried out on the coating surface analysis. Those results has been use to optimize the further design and platform of the enhanced K-PRTV pollution flash coating experiment. It is also to improve the plan formulation, formulation optimization and preparation of the hydrophobic modified K-PRTV which is based on anti-pollution coating experiment. More importantly, the anti-pollution flashover K-PRTV coating with super hydrophobic modified is the great significance for K-PRTV coating.

1. Introduction
RTV is polysiloxane materials for the synthesis of new types of anti-pollution flashover dope also with polysiloxane (or organic silicon) as a basic material for modification. For RTV anti-icing problem, north China electric power university and China electric institute the RTV + nano TiO2 system can improve the ability of anti-icing and antifouling flash [1]. Electrical design research institute of Canada RTV + 10~30% fluoride particles + 35~45% Al (OH)3 system, its contact Angle is higher than 145 degrees, have good ultraviolet aging resistance and hydrophobic [2]. Using domestic sanming university CF4 rf plasma surface treatment of silicone rubber, add fluoride functional groups and improve the surface roughness, thus improve the silicone rubber surface hydrophobic and oleophobic property, contact Angle increased from 100.7 degrees to 150.2 degrees [3]. Kyushu university of science and technology using polysiloxane + nano or micro SiO2+Al(OH)3 system [4], after electric mark, breakdown, refractory and contact Angle test, found that the effect of the added to improve the hydrophobic nano SiO2 is not significant, while the hydrophobic effect of the micron SiO2 is better. Indonesia has developed a system of epoxy resin + polysiloxane + RHA [5], Beijing normal university and qinghua university, polyamide (finishing) + fluorine silicone + TiO2 phlogopite system, using the TiO2 photo catalysis semiconductor effect, make the system the dirty lightning pressure increased by 31.85% than that of polyamide [6].

Because of RTV aging fast, inorganic oxide can significantly improve the anti-aging performance, so as to extend the life of the coating. So, choose the high contact Angle and strong ability to pollutants of inorganic oxide can be used as antifouling flash coating. The present study system mainly has two kinds of HfO2 and TiO2. Indonesia sedimentary HfO2 thin films on glass insulator, the contact Angle of 102.25 degrees, won the good hydrophobic and insulating performance [7]. Colombia on the
porcelain insulator deposition TiO2 thin films, the use of TiO2 photo analysis, the surface has the clean function, removal of organic pollutants, can reach 25 ~ 30 years of life, but cannot remove inorganic pollutants [8, 9].

From the point of the current new antifouling flash technology, most to RTV coating modification research. The main technical means, to basic material modification and add nano or micro filler is given priority, but it is lack of study on the application of the system performance.

2. Experimental details

2.1. Materials
50 * 80 mm, 80 * 100 mm will be putted in in a beaker of anhydrous ethanol with two kinds of size of glass, the beaker into the ultrasonic cleaners cleaning in 20 min, dried with anhydrous ethanol with blower to dry after use. Respectively in the two dimensions of RTV coating glass preparation, cured after 24 h.

2.2. Characterization
The morphology of steel wires was examined by using Scanning Electron Microscope (SEM) Optical profile meter, atomic force microscopy (AFM). The IR analysis was carried out using a Fourier infrared tester in room temperature. Those tests were replicated about 3-5 times.tables or figures from other Publications, they must ask the corresponding publishers to grant them the right to publish this material in their paper.

3. Results and Discussion

3.1. Morphology analysis of K-PRTV within nano SiO2
K-PRTV was putted on the glass surface with 50 * 80 mm. It besmear brushes 3 or 5 times, respectively. For the different amount of nano SiO2, All specimens are marked for PR1 which represents 10%, PR2 represents 20%, PR3 represents 30%, respectively.

Figure 1. AFM morphology of PR1 with 10% nano SiO2
With comparison, the pictures of AFM can show the 3D features of K-PRTV with different amount of nano SiO2. PR3 with 30% nano SiO2 show the best morphology.

3.2. Morphology analysis of K-PRTV within nano SiO2 by Optical Profiler
The optical profile meter is used to measure the thickness of each sample, as shown in Fig.4. And coating thickness of up to 80 um, comparatively large difference, so the late besmear to brush with the payment, 24 h after curing, using optical profile meter to measure the thickness
Figure 4. Morphology analysis of K-PRTV within nano SiO2 by Optical Profiler, (a) surface topography, (b) depth variation

3.3. FT-IR analysis of K-PRTV
Using FTIR test enhancement RTV, spectra and K-PRTV, determine the RTV, K-PRTV matrix material is polydimethylsiloxane. Choosing RTV and sample each one, using Nicoletis10 Fourier transform infrared spectrometer spectra comparison, to determine the composition of the coating functional groups.

Figure 5. FTIR infrared spectrogram of RTV and K-PRTV (red to enhance RTV, blue for K-PRTV).
Observed, RTV and K-PRTV spectra are consistent, and the spectra of polydimethylsiloxane, so a matrix can be set for the two kinds of coating materials for polydimethylsiloxane, containing, as shown in Figure 5. Compared with standard IR spectra, can determine, 1000 near the peak for Si-O keys, 3000 near the peak for C-H keys, 1250 and 800 near the peak of Si-CH3.

3.4. Morphology analysis of K-PRTV with super hydrophobic modification
The cross section morphology of coating aes shown in Fig. 6 and Fig. 7. Compared to the pure zinc coating, zinc - 0.2% without obvious Al zinc - Fe alloy layer (i.e. Γ layer, zeta layer and delta), may be related to join Al to prevent the formation of zinc - Fe alloy layer, pure zinc plating section phase is given priority to, as shown in figure 9.

3.5. Rough analysis and Hydrophobic Angle test
Glass sandblasting surface treatment was used to test the abrasive resistance of coating. In low roughness of coating on the glass, K-RTV presents good durability. In Fig. 8, the rough morphology of K-RTV and RTV show the obvious difference in both coatings.
Figure 8. AFM morphology of (a) K-PRTV with 30% nano SiO2 and (b) RTV after the rough test.

A distinct difference in the morphological features of K-RTV and RTV exhibits in Fig.8 (a) and (b) clearly that K-RTV has more order microstructure than the RTV which indicates that the K-RTV indeed has higher rough durability. However, in the Fig 8b, the SEM image of RTV exhibits a rough wrinkled and wrinkled morphology.

Figure 9. The contact angle test of K-RTV

As shown in the Fig.9, the water contact angle on solid surface reaches up to 147° when apply the K-RTV on glass. The increase of contact angle between the water and glass surface make solid surface easily to clean contamination material in their paper.

4. Conclusion

In this work, an enhanced K-PRTV anti-pollution flashover coating had been prepared by adding nano SiO2 particles. The experiment results have been use to optimize the further design and platform of the enhanced K-PRTV pollution flash coating experiment. K-PRTV has the higher rough durability and greater contact angle which is based on the modification effect of nano SiO2 particles. More importantly, the K-PRTV coating with super hydrophobic modified has an improved significance for anti-pollution flashover coating.

Acknowledgments

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