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Recent progress in the development of nanomaterials-based sensors for applications in SF_6 insulated equipment monitoring

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Sulfur hexafluoride (SF_6) insulating gas possesses outstanding arc quenching and insulation performance, which is the most, used filled gas in gas-insulated equipment, such as gas-insulated switchgear (GIS), gas-insulated lines (GIL), gas circuit breaker (GCB). However, SF_6 gas will inevitably decompose to components (SO_2, H_2S, SOF_2, SO_2F_2 and CF_4 *et. al.*) under partial discharge and disruptive discharge (surface flashover and creeping discharge) due to the occurred insulation defects in production and long term operation process. The decomposition of SF_6, which significantly reduces the dielectric strength of SF_6 insulted equipment, may eventually lead to the breakdown of insulation equipment and even paralyze the whole power supply system. Therefore, detecting the insulation status becomes indispensable in an attempt to ensure the running stability of insulation equipment. Basing on current high sensitive chemi-resistor detection method, the insulation status of SF_6-insulated equipment can be monitored on-line in real time through detecting the decomposition components: SO_2, H_2S, SOF_2 and SO_2F_2. This study introduces the research progress of gas sensors using different materials such as modi-TiO_2 nanotubes, single wall carbon nano-tube and polyaniline thin-film. In order to understand to detection mechanism, the adsorption properties for gas molecules of decomposition components on the surface of gas sensitive material are studied based on the $Dmol^3$ module of Materials Studio. In addition, the sensitivity and selectivity of prepared gas sensor to different decomposition components are studied under different pressures, concentration and temperature.

Biography

Xiaoxing Zhang received his Master's degree from Hubei University of Technology. In 2006, he received PhD from School of Electrical Engineering, Chongqing University. From 2003 to 2013, he worked at Chongqing University as Director of High Voltage laboratory and Associated Director of State Key Laboratory of Power Transmission Equipment & System Security and New Technology. In January 2014, he was transferred to work at the School of Electrical Engineering, Wuhan University. He has published 184 papers in domestic and international academic journals and conferences. His research interests include researching on-line monitoring and fault diagnosis for high voltage electrical equipment for a long time. He has introduced advanced nanotechnology to detect SF_6 fault characteristic gases and successfully synthesized highly sensitive and selective nano-sensors.

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