Abstracts

Dissolved gas analysis has been accepted worldwide as the most practical diagnostic method for detecting incipient transformer faults. However, simultaneous detection of multi-trace gases (H2, CO, CO2, CH4, C2H2, C2H4 and C2H6) is still a challenge with high accuracy and sensitivity. In this paper, for the first time, the technology of Raman spectroscopy was used to achieve qualitative and quantitative analysis of fault gases extracted from transformer oil. Firstly, the fundamentals of Raman spectroscopy for molecular detection was introduced and discussed. Then based on our home-built Raman system, the simultaneous measurement of seven kinds of fault gases was achieved qualitatively. And one or more Raman variations of each gas species had been detected. For convenience and sensitivity of gas measurement, the characteristic Raman variations of H2 (4160 cm-1), CO (2142 cm-1), CO2 (1388 cm-1), CH4 (2917 cm-1), C2H2 (1973 cm-1), C2H4 (1344 cm-1) and C2H6 (2955 cm-1) were summarized and demonstrated. Besides, according to least square method, the linear relation between Raman intensity and the concentration of gas species was deduced. In addition, the minimum measurable concentrations of different fault gases had been obtained: H2 (15350 µL/L), CO (25300 µL/L), CO2 (18000 µL/L), CH4 (3400 µL/L), C2H2 (5000 µL/L), C2H4 (10100 µL/L) and C2H6 (6250 µL/L), which is quite high. But, as a new method, Raman spectroscopy has the potential to suit the simultaneous detection of fault gases extracted from transformer oil if the weakness of poor sensitivity can be solved out. We trying to build up an optical feedback cavity enhanced Raman system to improve the minimum measurable concentrations for gases extracted from transformer oil.