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Quantitative analysis of multi-component alkane mixture with fourier transform infrared spectrometer based on TR-LSSVM-PSO

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Analysis of organic gas is used in many fields such as well logging, mine safety, fault forecast of power transformer, and so on. Compared to gas chromatography, the common way used for organic gas analysis, Fourier transform infrared spectroscopy (FTIR) has such advantages as fast analysis and update rate, no carrier gas requirement, less susceptible to clogging, etc. However, there are also many challenges for on-line analysis of organic gas such as alkane gases through FTIR because of serious overlapping in their absorption spectra, nonlinearity between gas concentration and absorbance because of low wave number resolution. And it may be a difficult work to analyze organic mixture through FTIR solely. In this work, on-line analysis of mud gas whose principal components include light alkane gases, carbon dioxide and carbon monoxide, is taken as an example to introduce the approach called as TR-LSSVM-PSO for organic gas mixture analysis through FTIR at first. TR-LSSVM-PSO means that feature extraction and selection is based on advanced Tikhonov Regularization, and the modeling method is based on Least Square Support Vector Machine and Particle Swarm Optimization. Then, this approach is used to analyze mud gas on-line compared with gas chromatograph. The analysis results show that two set of result curves overlap with each other. That means that the proposed TR-LSSVM-PSO in this paper can be applied independently for on-line analysis of alkane gas mixture, and can effectively find thin oil-gas reservoir because of its potential of fast analysis.

Biography

Xiaojun Tang has completed his PhD from Xi'an Jiaotong University and Postdoctoral studies from institute of advance material, University of New Orleans. He is the department head of measurement science and technology, School of Electrical Engineering, Xi'an Jiaotong University. He has published more than 40 papers in reputed journals. Feng Zhang has completed his master's degree from Xi'an Polytechnic University and he is studying his PhD at Xi'an JiaoTong University, and his research direction is the spectral analysis technique. Hailin Zhang has completed her bachelor's degree from Hebei Normal University and she is studying her PhD at Xi'an JiaoTong University, and her research direction is the spectral analysis technique.

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