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重油含水率测量系统中的信息融合方法

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摘 要：在重油含水率测量系统中,根据水的介电常数远远大于重油的介电常数,因而两者所呈现的射频阻抗特性不同的原理,可使用射频电容传感器.但在测试过程中发现传感器的输出除受水分这1个参量的影响外,还受温度的影响,从而影响系统性能和测量精度.为此,探讨了对传感器输入、输出信息进行融合处理的方法,以提高目标参量的测量精度和测量系统的温度稳定性.2个传感器所输出的信息融合方法有多种,作者采用了曲面拟合法.实验结果表明:未进行信息融合前,传感器的零位温度系数$\alpha s0=4.01\times10^{-3}$/℃,在水分标定值为3%,8%和10%时,传感器的灵敏温度系数$\alpha s3$,$\alpha s8$,$\alpha s10$分别为3.56×10^{-3},3.53×10^{-3}和3.30×10^{-3}/℃;进行信息融合后,传感器的等效温度系数$\alpha s0$,$\alpha s3$,$\alpha s8$和$\alpha s10$分别为1.06×10^{-3},2.43×10^{-3},8.66×10^{-4}和8.50×10^{-4}/℃,与未融合处理前相比,温度稳定性有较大的提高,同时测量精度也明显提高.

关键字：含水率;射频传感器;信息融合

The information fusion method in the system of water content measurement in heavy oil

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Abstract: In the system of water content measurement in heavy oil, radio-frequency capacitance sensors are adopted based on the principle that the dielectric constant of water is fargreater than that of heavy oil,and thus the reflected specific properties are different in the respect of radio frequency impedance. But duo to the cross sensitivity of sensors to temperature, the authors explore how to employ the information fusion method in the melting processing the input and out-
put information of sensors to improve the measuring precision of the target parameter and the temperature stability of the measuring system. There are many methods to melt two kinds of information. The authors have adopted the method of curved surface fitting. Based on sensors′property tests by using lubricant, the results showthat the sensitive temperature coefficient successively is 4.01×10^{-3}, 3.56×10^{-3}, $3.53\times10^{-3}$and 3.30×10^{-3}/℃before information fusion processing, when the water contents were labeled as 0%, 3%, 8% and 10%. But after information-fusion processing, it is 1.06×10^{-3}, 2.43×10^{-3}, 8.66×10^{-4} and 8.50×10^{-4}/℃. Both the temperature stability and the measuring precision improved greatly compared with that before melting-processing.

Key words:water content; radio-frequency sensor; information fusion

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