Vandens kiekio naftos dujinėje ir skystoje būsenose įvertinimas terahercų laikinės spektroskopijos metodu.

Evaluation of water content in gaseous and liquid phases of petroleum using terahertz time-domain spectroscopy.

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Recent advancements have seen the application of terahertz time-domain spectroscopy in measuring water content in crude oil and petrochemicals [1,2]. The accuracy of this method rivals the distillation technique but boasts a much faster measurement speed. In this study, we delve deeper into the potential of the terahertz time-domain spectroscopy technique for gauging water content in oil. To ensure accuracy, we supplemented absorption measurements with refractive index studies. Furthermore, we introduced a novel methodology for assessing the gas phase of petroleum using terahertz pulses (Fig.1).

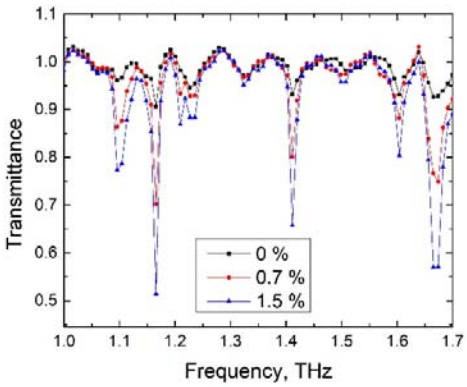

Fig. 1. Transmittance of gaseous petroleum samples to terahertz radiation. Higher water concentration leads to more intense water vapor absorption lines

Oil samples underwent measurements in a transmission geometry setup. Within the range studied, a linear correlation between the terahertz pulse amplitude and the water content in petroleum was evident (Fig. 2). The absorption coefficient of petroleum samples ascended with frequency, yet the imaginary part of the complex refractive index remained unaltered by frequency for oils with low water content. However, for samples with higher water content, a decline in the refractive index was noted with increasing frequency. The real part of the refractive index is influenced by frequency, but its magnitude is mostly unaffected by the water content. In contrast, the magnitude of the imaginary part of the refractive index scales with water content.

Our findings underscore the versatility of the terahertz time-domain spectroscopy technique, marking its potential for both laboratory assessments and real-time monitoring in oil production and transportation facilities.

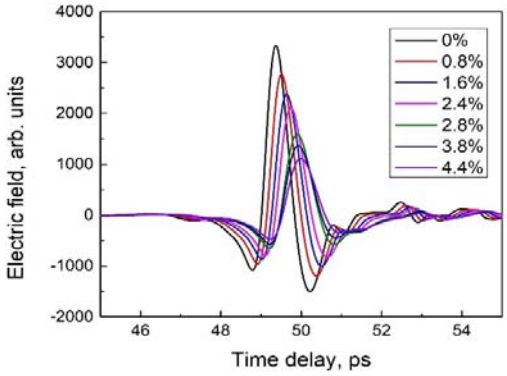

Fig. 2. THz pulses passed through liquid petroleum samples. Higher amplitude terahertz pulses pass through samples with lower water concentration.

Reikšminiai žodžiai:
terahercų spektroskopija, teraherciniai impulsai.

Literature

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