

THz-based spectral images of oil shales

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The remarkable properties of THz pulses have been attracting wide communities including but not limited to researchers, industrialist and medical experts^{1,2}. THz pulses have enabled the study of a broad list of materials ranging from cellular organism to matter. In the framework of our research, we investigate the application of THz pulses to probe oil shales. Oil shales are combustible source rock, composed of minerals and kerogen. The kerogen constituent of an oil shale is a delicate and complex heterogeneous organic substance consisting of a small percentage by mass of the total weight of the oil shale. Their aromatic and functional groups which largely contributes to the oil yield of oil shales have rotational and vibrational modes within the THz frequency range².

Oil shales from five (5) different geographical locations in Lokpanta, Nigeria are been analyzed. At each locations, the oil shales been extracted at different heights above the ground level, would create an avenue to investigate the variation of the oil shale constituents with height. We are currently probing the oil shales both in the transmission and reflection mode of THz spectroscopy in order to extract information as per their refractive index, optical path length and absorption profile which will aid the development of contrast maps indicating the distribution of their kerogen and mineral composition. The photograph of an oil shale sample as seen in Fig 1.0(a) consist of a varying proportion of kerogen as illustrated by the reflection THz spectroscopy image in Fig 1.0(b). The normalized reflected THz amplitude is represented by the patches of colors in the spectral image. The THz pulses were strongly absorbed in the dark red regions, and faintly absorbed in the yellowish area, in which case confirms the predominance of kerogen in the sample.

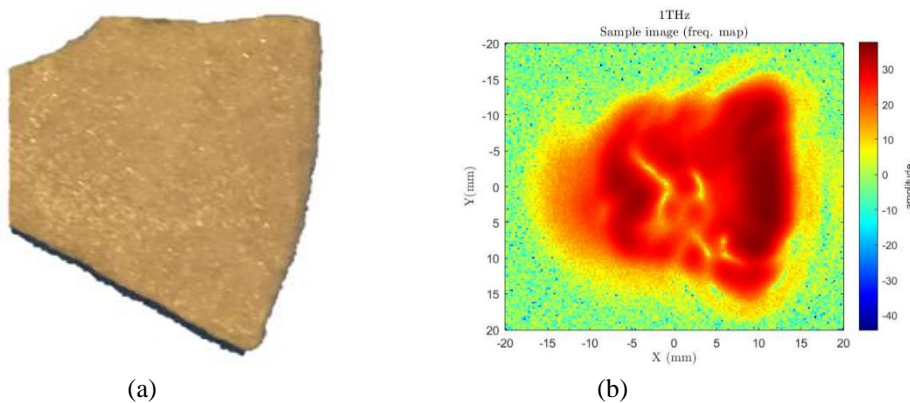


Fig 1.0. An oil shale photograph and absorption map of the shale retrieved at 1.0 THz.

The images and spectroscopic measurements of the other oil shale samples will be presented. The overall objective of this work has been the visualization of organic distribution and contents in oil shales, in which we have demonstrated the utility of THz imaging technology to predict the occurrence state of the organics in an oil shale.

Reference

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