

7.4 Dielectric Properties of Jordanian Oil Shale

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Microwave heating has been suggested by various authors as a suitable technology for extraction of organic material from oil shale. However, one of the limiting factors in the development of this technology is a lack of accurate dielectric property data for design purposes. In this study the dielectric behaviour of Ellajun oil shale, from the Karak area of Jordan, is quantified. The dielectric constant and loss factor of Ellajun oil shale were measured at frequencies of 2450 and 911MHz using the hot cavity perturbation technique. Representative samples covering a wide range of organic matter contents were collected across the whole height of an Ellajun surface outcrop. The effects of sample location, organic content, temperature, and moisture content on the microwave heating efficiency ($\tan \delta$) were quantified. Generally, it was found that all samples were of low dielectric loss factor at room temperature with the loss factor falling significantly after the moisture was removed. This suggests that the major contribution to the dielectric loss is from the presence of free or interlayer water. It was found that both dielectric constant and loss factor increased with a rise in temperature from 20 up to 80°C, and then dropped significantly at about 100°C before staying approximately constant up to a temperature of about 480°C. From this point both dielectric constant and loss factor increased sharply with further temperature rise. An attempt was also made to correlate the dielectric properties of the bulk shale sample with the organic content, the total carbon, (total inorganic and organic carbon). However, no correlation between dielectric properties and organic matter content was found.