

Jordan University of Science and Technology

Microwave processing of Oil Sands and contribution of clay minerals

Authors: John Robinson, Eleanor Binner, Abdul Saeid , Mohammed Al-Harabsheh, Sam Kingman

Abstract: This study establishes the feasibility of microwave heating for extracting oil from Oil Sands in ex-situ processes. Previous studies in this area have shown some potential, but have not characterised the dielectric properties of the Oil Sands used, nor related them to the mineral composition, both of which are vital if successful scale up is to be achieved. In this work the fundamental interactions of microwave energy with Oil Sands are investigated and understood for the first time, and the material characterisation related to microwave heating and oil extraction studies is carried out. It is shown that microwave heating is not feasible for extracting oil from High Grade Oil Sands due to their very low water content (<0.5%), and consequently their low dielectric loss factor. Low Grade Oil Sands can be processed, with bitumen recoveries in excess of 50% shown in this work, and energy requirements around 200 kW h/tonne. Low Grade sands contain significant clay fines and have a higher water content (5%). This water is bound within the clay minerals, and allows temperatures in excess of 300 C to be achieved during processing. The presence of hydrated clay minerals (predominantly kaolinite) is the key characteristic that makes Low Grade Oil Sands amenable to microwave heating. The clay minerals present in the Low Grade Oil Sands make them undesirable for conventional processing, and this study shows that microwave heating could provide a dry-processing route for recovery of bitumen from clay-containing feedstocks.