

Abstract No. chou237

FTIR Micro-Spectroscopy Study of Petroleum Rod Wax Deposits Formed in an Oil-Producing Well

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Beamline(s): U2B

ABSTRACT: A major problem for the development of efficient preventive and remediation technologies in oil well equipment is deposition of complex organic mixtures under the changing pressure and temperature conditions. These solid deposits are dominated by long-chain hydrocarbons with various proportions of resins/asphaltenes, trapped oil, water, and inorganic material. The present study is a part of a series of studies performed at the X19A and X26A beamlines to characterize the same sample set of naturally-formed wax deposits collected from the sucker pump rods of an oil-producing well. Samples were taken in order or increasing depth and temperature and encompassed depth and temperature ranges of ca 6000 ft. and 30°C, respectively. Imaging and compositional information are obtained by FTIR micro-spectroscopy at U2B.

The preliminary results indicate the presence of two major types of aggregates in the same wax deposit. Predominantly non-polar aggregates show strong characteristic bands of CH₂ and CH₃ groups that could be related to long-chain normal and iso-alkanes identified by our previous high-temperature gas chromatography studies. FTIR mapping of a single aggregate revealed a heterogeneous distribution of the hydrocarbons and presence of carboxylic acids with identical distribution to the hydrocarbons, but in lower concentration. The occurrence and distribution of carboxylic acids, most likely long-chain acids, is a new finding and could be related to the processes associated with oil-water interfacial phenomena and interactions in micro-emulsions.