

## Thermooxidative decomposition of oil shales

### INTRODUCTION

Oil shales (OS) are sedimentary rocks with varying amounts of combustible organic matter in a mineral medium. The quality of oil shale depends on the organic matter and mineral part amount and composition. They determine the possible applications of the shale as a raw material for chemical and/or power industry. The thermooxidative decomposition of oil shale samples in a thermal analyzer helps at determining these data.

### EXPERIMENT

- 15±0.2 mg oil shale samples from Estonia, Jordan, Israel and Morocco
- THEMYS TG-DTA
- Heating rates from 1 to 20°C/min
- Coupled to a Nicolet 380 FTIR Spectrometer by a heated transfer line
- Atmosphere: 80% of Ar and 20% of O<sub>2</sub>

### RESULTS AND CONCLUSION

#### TG, DTG and DTA show:

- Emission of sorbed water 200–250°C (0.9–2.5% range)
- First, low temperature stage: exothermic thermooxidation of volatile organic compounds (exo)
- Mid temperature stage: exothermic thermooxidation of heavier organics (kerogen) and fixed carbon as well as of pyrite (FeS<sub>2</sub>)
- High temperature: endothermic decomposition of carbonates

#### FTIR data show:

- Two major gaseous compounds, all fuels : CO<sub>2</sub> and H<sub>2</sub>O
- All fuels, more minor gases: CO, acetic and formic acids, formaldehyde, acetaldehyde, ketones, SO<sub>2</sub>, ethane and chlorobenzene
- Israel and Morocco : emission of traces of ethylene, methanol and ethanol
- These differences can be explained by the differences in the content of organic matter

Reference: Kaljuvee et al, *J Therm Anal Calorim* (2011) 105:395–403

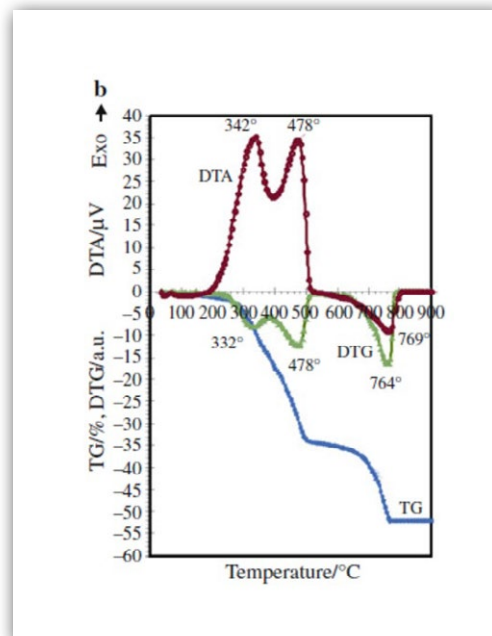


Figure - Thermoanalytical curves at 5°C/min for Estonian Oil Shale

### INSTRUMENT

#### THEMYS STA



ACCURATE AND SENSITIVE ULTRA-HIGH TEMPERATURE heat flow measurement with Tri-Couple DTA technology

ULTRA-HIGH TEMPERATURE CAPABILITY to 2400°C with a single furnace.

MODULAR ADAPTIONS ALLOWING TGA only, DTA only, TG-DTA, and TMA up to 2400°C, DSC only and TG-DSC up to 1600°C all in one instrument

EXTERNAL COUPLING CAPABILITY designed for evolved gas analyzers (FTIR, MS, GCMS, MSFTIR, or FTIR-GCMS)