

Remarkable thermal stability of C_{2,3,4} heavy hydrocarbon gases from oil

YUNPENG WANG^{1*}, CHANGYI ZHAO², HONGJUN WANG²
JINZHONG LIU¹ AND JIALAN LU¹

¹SKLOG, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China
(*correspondence: wangyp@gig.ac.cn)

²RIPED of PetroChina, Beijing 100083, China

Ethane, propane and butane are intermediates in oil cracking to gas [1]. Closed gold tube experimentation provides a suitable way to study their thermal stability. Two issues are pertinent in modeling the cracking of gaseous molecules [2]: (1) maximum yield determination of heavy hydrocarbon gases and their variation with heating rates, and (2) onset temperature of cracking. The first issue being settled by Shuai *et al.* [2]. We focussed on the second issue to determine the onset temperature of heavy gas cracking. We combined two Gaussians to describe yield as a function of pyrolysis temperature: one centered at lower T to model generation, the other centered at higher T to model cracking. Fig. 1 shows a comparison between model and experiment for ethane. With our model we can calculate the kerogen-ethane kinetics: activation energies for ethane cracking around 74-84 kcal/mol with a frequency factor of $8.24 \times 10^{15} \text{ s}^{-1}$, calculated cracking temperatures were around 220-320°C at geologic heating rate (2°C/my). These temperatures are much higher than the cracking temperature of coal-derived ethane, ranging between 160-230°C [2]. Propane and butane exhibit similar results, suggesting that the oil-associated heavy gases are remarkably stable under natural conditions.

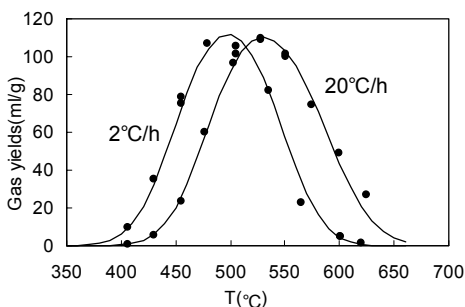


Figure 1: The laboratory (spot) and modeling results (line) of ethane (C₂) of an oil from Tarim Basin in a closed system.

[1] Dieckmann *et al.* (2004) *Org. Geochem.* **35**, 845–862.

[2] Shuai *et al.* (2006) *Org. Geochem.* **37**, 932–943.

An *in situ* laser fluorescence column profiler for monitoring nanoporous particle transport in porous media

ZHEMING WANG, CHONGXUAN LIU, JOHN M. ZACHARA,
KAKE ZHU, JUAN LI AND JUN LIU

Pacific Northwest National Laboratory, Richland, WA 99352,
USA

Various nanoporous materials have been developed in the last decade for research and industry applications such as in energy storage and fuel cell technology, catalysis, photonics, biology and bioengineering, and environmental remediation. Functionalized nanoporous materials, in particular, have shown the great potential to sequester many toxic contaminants and radionuclides from liquid wastes and groundwaters. Most of the nanoporous materials will eventually enter subsurface porous media either intentionally or unintentionally that may affect groundwater quality. However, currently there is little understanding of the fate and transport of the nanoporous materials in subsurface environments.

Particle transport is typically studied in column systems by varying experimental conditions and observing the responses of particle concentrations in column effluents. *In situ* measurements of particle transport are rarely performed because of technical difficulty in detecting particles in porous media.

In this work, we have developed a scanning optical fiber-laser excitation fluorescence profiler system that can *in situ* track the transport of nanoporous particles in a column system. In this system, an array of optical fibers is installed at different locations within the column and the excitation laser beam is sequentially directed into the optical fibers to incident on the porous media inside the column. The emitted fluorescence is collected by the same fiber and after dispersed through a spectral graph the fluorescence spectra are recorded by an intensified CCD camera. The application of the system is demonstrated by real-time delineation of the concentration profiles of nanoporous particles along column longitudinal direction. The nanoporous particles contain highly uniform, nanoscale pores that are surface-modified with covalently bonded-salicylamide functional groups, which can produce fluorescence and sequester uranium in groundwater.