A Novel 9.4 Tesla FT-ICR Mass Spectrometer with Improved Sensitivity, Mass Resolution, and Mass Range, for Petroleum Heavy Crude Oil Analysis

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Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometry provides unparalleled mass measurement accuracy and resolving power for complex organic mixtures. However, analysis of petroleum crude oil as well as upcoming biofuels requires continued advances in instrument speed and sensitivity.

We have redesigned our custom-built 9.4 tesla FT-ICR mass spectrometer to improve sensitivity (factor of 2), broadband mass resolution (factor of 2), and broadband mass accuracy (factor of 5), with a modular design that facilitates exchange of new components for future development.

For example, Figure 1 shows resolution of sulfur containing from non-sulfur containing components whose masses differ by ~0.001 mass unit--enabling for the first time unique identification of sulfur-containing species in petroleum crude oil and its products, extending to "heavy" crudes that are the most problematic for refineries.

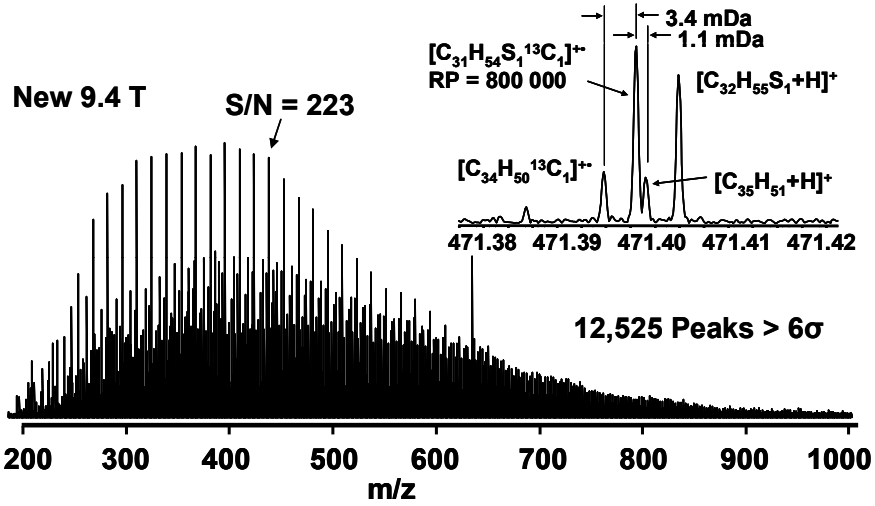

Figure 1. Positive-ion atmospheric pressure photoionization mass spectrum of a Middle Eastern light crude oil, acquired with the new NHMFL 9.4 T FT-ICR mass spectrometer. The inset illustrates resolution of the mass splits (1.1 mDa and 3.4 mDa) required for unequivocal identification of sulfur-containing components in petroloeum heavy crude oils.

Facilities: NHMFL 9.4 tesla widebore FT-ICR mass spectrometer.

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