What is claimed is:

1. A method for developing a model of composition for a heavy hydrocarbon sample, comprising:

separating a heavy hydrocarbon sample having a T5 boiling point of at least about 350°C to form a plurality of composition groups, including at least one saturates group;

measuring a weight percentage for composition groups formed by separation of the heavy hydrocarbon sample;

determining elemental formulas, structures, and relative amounts for compounds within separated composition groups using mass spectrometry, wherein the structures determined for compounds within the at least one saturates group are 0-12 naphthene ring structures, the ions for the mass spectrometry being formed using a soft ionization method; and

calculating a model of composition for the heavy hydrocarbon sample based on the measured weight percentages for the composition groups, the determined elemental formulas for compounds within the separated composition groups, and the determined relative amounts for compounds within the separated composition groups,

wherein the ions for the mass spectrometry of the at least one saturates group are formed using laser desorption ionization;

directly measuring molecular weight distribution, bulk properties, average structures, and heteroatom types;

adjusting the calculated model of composition to match the properties directly measured to obtain an adjusted model of composition.

2. The method of claim 1, wherein at least one of the heavy hydrocarbon sample and the at least one saturates group has an initial boiling point of at least about 400°C.

3. The method of claim 1, wherein less than about 5 wt% of the heavy hydrocarbon sample comprises compounds with a molecular weight of less than 400 Daltons.

4. The method of claim 1, wherein less than about 5 wt% of the at least one saturates composition group comprises compounds with a molecular weight of less than 400 Daltons.

5. The method of claim 1, wherein separating the heavy hydrocarbon sample comprises deasphalting the heavy hydrocarbon sample to form an asphaltenes composition group and a deasphalted oil, and separating the deasphalted oil to form the at least one saturates composition group, the at least one aromatics composition group, at least one sulfide composition group, and the at least one polar composition group.

6. The method of claim 1, wherein directly measuring molecular weight distribution comprises using field desorption mass spectrometry.

7. The method of claim 1, wherein directly measuring bulk properties comprises measuring at least one of elemental composition by elemental analysis, boiling point by high temperature simulated distillation, and microcarbon residue or conradson carbon residue.

8. The method of claim 1, wherein directly measuring average structures comprises measuring at least one of % Aromatic carbon (Ca), average aromatic cluster size (C#), amount of C in long chains, and degree of chain branching by nuclear magnetic resonance.

9. The method of claim 1, wherein directly measuring heteroatom types comprises using X-ray Photoelectron Spectroscopy.