FROM CHEMICAL PROPERTIES TO PERFORMANCE OF ASPHALT MATERIALS

Session I: Introduction — JP Planche 8:00 – 8:20 am
- What are the challenges?
- How is asphalt produced?
- Crude and process dependencies
- Why is this important – US and International supply context

Session II (A): Asphalt Composition — Troy Pauli 8:20 – 9:10 am
- Composition, microstructure, physical/chemical properties related to mechanical response
- Colloidal-Phenomenological modeling of asphalt viscosity/composition based on asphalt physicochemical and chemomechanical properties
- Thermodynamic, kinetic and rheological consideration of the colloidal-phenomenological model
- Evidence for the internal microstructure of asphalt
- Surface microstructuring and wax composition - relations to bulk composition of asphalt
- Surface and bulk microstructure phenomena as these relate to asphalt pavement damage response and performance.

Session II (B): SAR-AD — Joe Rovani 9:10 – 9:25 am
- Intro to SAR-AD
- What chemical data does SAR-AD yield?
- SAR-AD compositional analysis is useful in binder formulation through blending, rejuvenation and modification as well as prediction of performance

Session II (C): DSC — Fred Turner 9:25 – 9:40 am
- Saturates - Crystallization
- How saturate structures influence crystallization and low temperature performance
- Microcrystalline waxes characterization by DSC and other methods
- Glass transition determination
- Glass transition: what part of asphalt composition is involved, what is the impact on low temperature performance, and how it changes with aging

Session II (D): Chemometric approach for rapid asphalt composition and mechanical response understanding — Ron Glaser 9:40 – 10:10 am
- Definitions (calibration or model)
- Need for multidimensional approach in asphalt
- Fitting multidimensional data
- Geometric visualization to make many dimensions understandable
• Mining data rich measurements: –case of spectra
• Example exercise

Break 10:10 – 10:25 am

Session III (A): Asphalt Oxidation — Ron Glaser 10:25 – 10:55 am
• Oxidative aging-considerations for pavement/IR
• Effects of oxidation
• Considerations for design - binder and permeability
• Considerations for maintenance: mill and fill, rejuvenation – importance of the extent of oxidation and SARA balance
• Kinetics studies on binders and how they relate to monitoring and predicting existing pavements

Session III (B): Physical Hardening — JP Planche 10:55 – 11:15 am
• Evidence of physical hardening
• Consequences on asphalt testing and properties
• Unknowns

Session IV: Asphalt Modification

Session IV (A): VTAE — JP Planche 11:15 – 11:45 pm
• What is VTAE / Usage of VTAE
• Characteristics of VTAE in comparison with asphalt
• Impact on asphalt structure and properties
• Unknowns

Lunch 11:45 – 12:45 pm

Session IV: Asphalt Modification – cont’d

Session IV (B): Polymers — JP Planche 12:45 – 1:15 pm
• Why modify with polymers
• Types of polymers used for asphalt modification
• Phase behavior and its impact on properties
• Production / Application / Performance examples

Session IV (C): Rejuvenators/RAP — Troy Pauli 1:15 – 1:45 pm
• Rejuvenators/RAP compatibility
• Colloidal-Phenomenological modeling of asphalt viscosity/composition and separation of variables approach to modeling RAP blends
• Chemomechanics of rejuvenator action on RAP blends.
• Novel experimental approach to study RAP blend compatibility
Session V: Binder Rheological Properties

Session V (A): PG grading — Alec Cookman 1:45 – 1:55 pm
- What is a PG?
- Why do we have PGs?
- How do you determine a PG?

Session V (B): Stress and Strain — Alec Cookman 1:55 – 2:05 pm
- Definitions of stress vs. strain
- How do stress and strain relate to the phase angle, and what is its physical meaning?
- How does a rheometer measure these properties in order to calculate the PG?

Session V (C): DDR and BBR testing — Alec Cookman 2:05 – 2:35 pm
- Meaning of dynamic and creep
- (4mm) DSR vs BBR: advantages and disadvantages
- How to calculate BBR m-value and creep stiffness from 4-mm DSR
- MSCR and LAST (maybe even touch on Lissajous plots briefly)

Session V (D): Testing Equipment — Steve Salmans 2:35 – 2:50 pm
- Details on 4-mm DSR
- How instrument compliance is measured and corrected
- Sample loading and trimming
- How to perform the required frequency sweeps

Break 2:50 – 3:05 pm

Session VI: Small Sample Testing — Mike Farrar 3:05 – 3:15 pm
- How to calculate the thermal stress build-up in the binder and pavement from a cooling event using 4-mm DSR
- 4-mm DSR coupled with the Asphalt Binder Cracking Device (ABCD) to calculate the critical cracking temperature (Tcr)
- Application of 4-mm DSR and spin-offs
  - Universal Simple Aging Test (USAT) (an alternative to standard RTFO and PAV)
  - Low temperature emulsion residue recovery and testing
  - Crack sealant and 4-mm DSR
  - Intermediate temperature testing of extremely stiff binders such as shingle material

Session VII: Field Sites — Mike Farrar 4:00 – 4:30 pm
- Micro-sampling and extraction for pavement and maintenance treatment investigation
- Rheological and chemical analysis of recovered binder and emulsion residue
- Field pavement and maintenance treatment performance related to rheological and chemical properties

**Session VIII: Identifying Contaminants and Reaction Products**
— Jeramie Adams  
4:30 - 4:40 pm
- Basic concept of NMR
- Determining soluble additives by NMR
- Quantification of some molecular parameters of asphalt by $^{13}$C NMR
  — Joe Rovani  
  4:40 - 4:50 pm
- Petroleum product types
- Applicable analysis techniques for each
- Forensic case studies

**Conclusions** — Planche/Salmans  
4:50 – 5:00 pm

**Lab Tour after Hours (optional)** — Rovani/Adams et al.  
5:00 – ??

**Reception Sponsored by Marathon Petroleum**  
5:00 – 7:00 pm