International Sustainable Pavements Workshop

Rubber Recycling

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A non-technical point

It is not just the technical issues..

Crumb rubber, as an asphalt modifier, should be considered based on performance, not because of federal/state funding as a solid waste material.

Funding should be directed to making better rubber modifiers, using better technologies..

INTRODUDTION

- Unique Nature
- Two Mechanisms:
  - Swelling
  - Devulcanization/Depolymerization
- Swelling Affects Binder Matrix
- Depolymerization Affects Liquid Phase

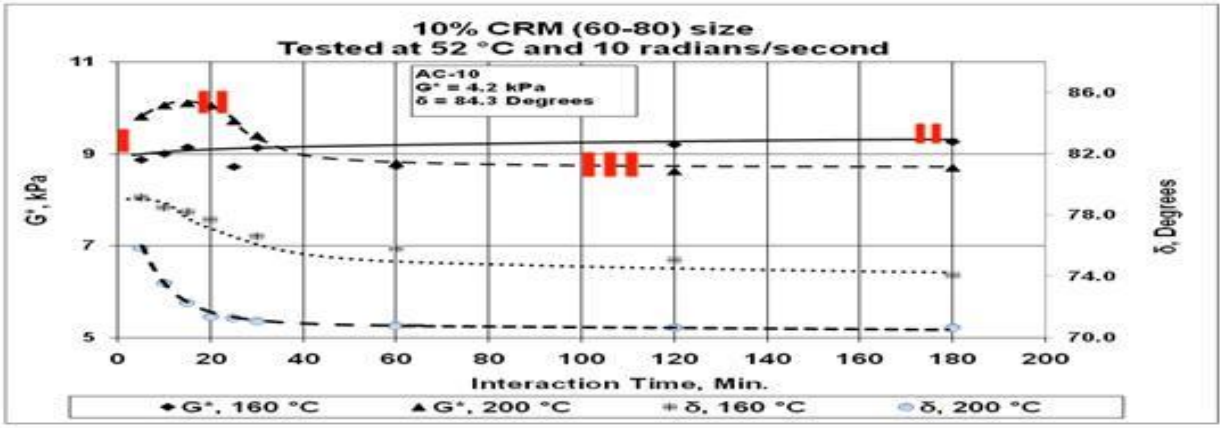
INTRODUCTION

Three Types of Interaction:

- Basic Asphalt-rubber interactions
- Asphalt-rubber interactions with added polymers
- Asphalt with pre-processed rubber

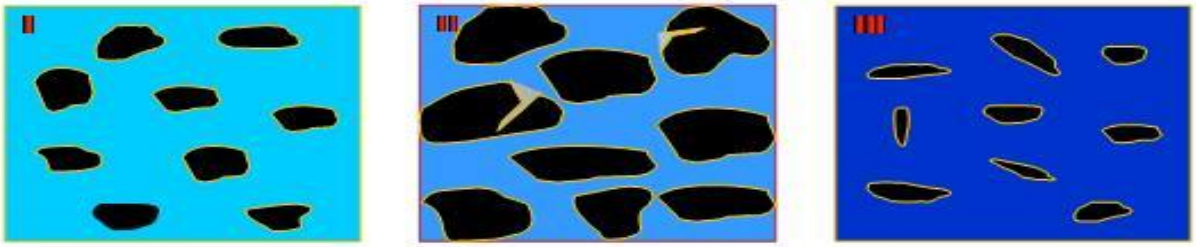
INTERACTION MECHANISM

a- Property development over time.

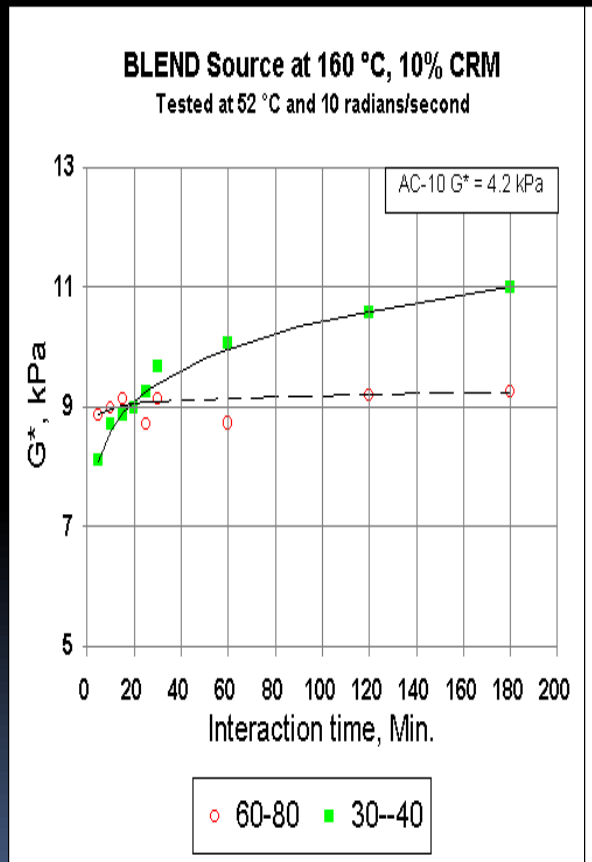


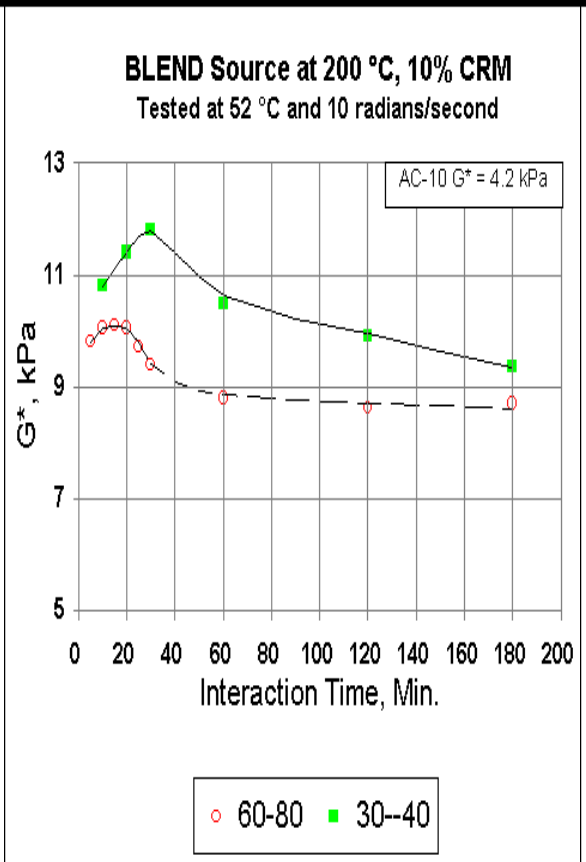
b- Change of particle size over time at elevated temperature.

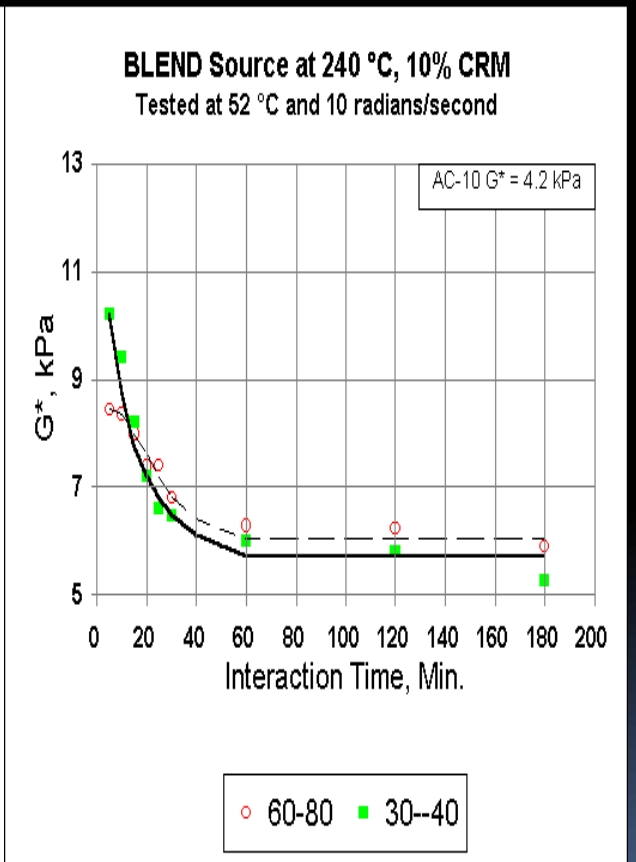
c- Change of binder matrix over time at elevated temperature.



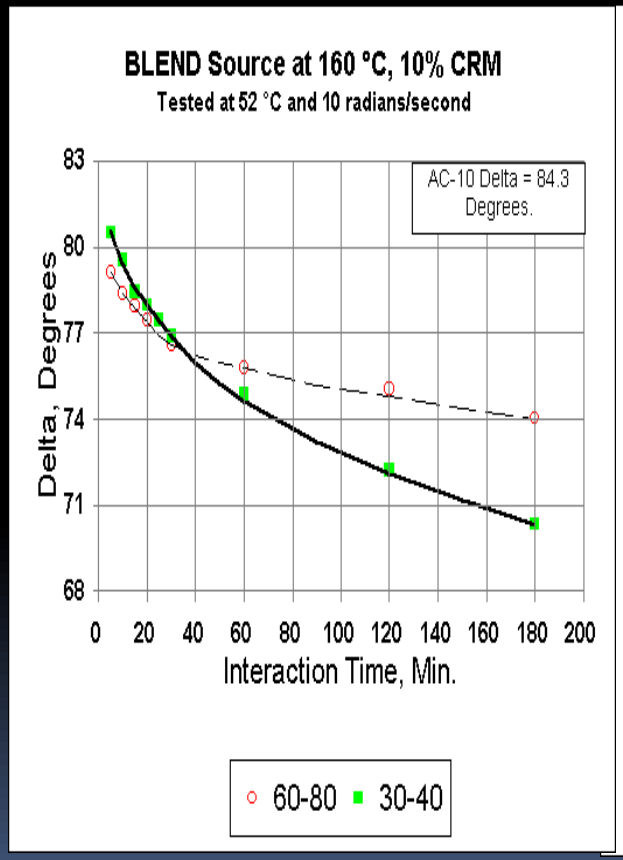
INTERACTION MECHANISM

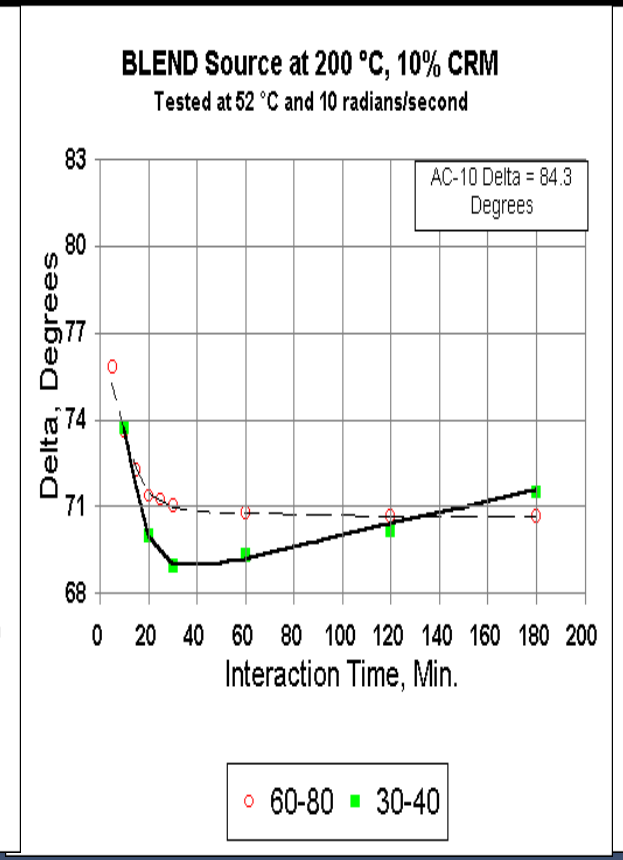


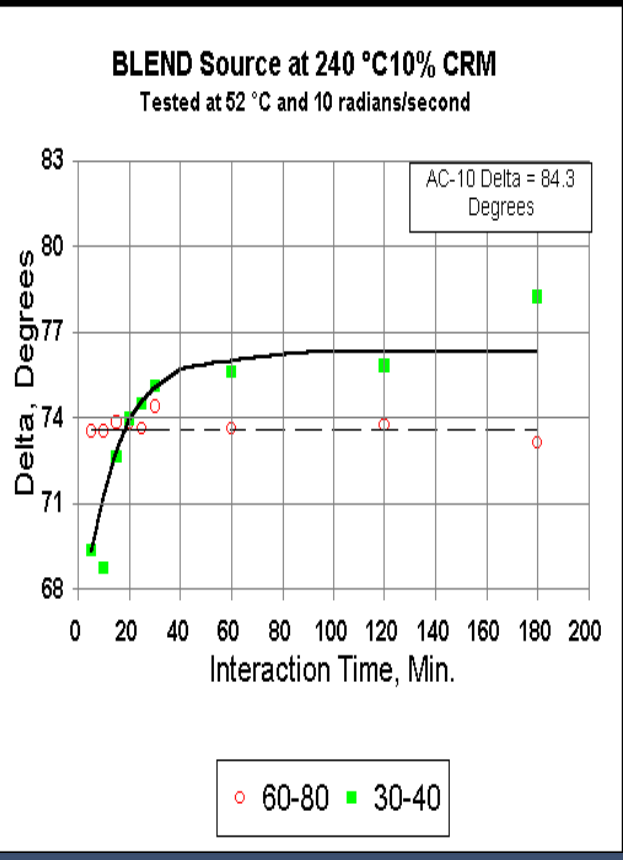




INTERACTION MECHANISM



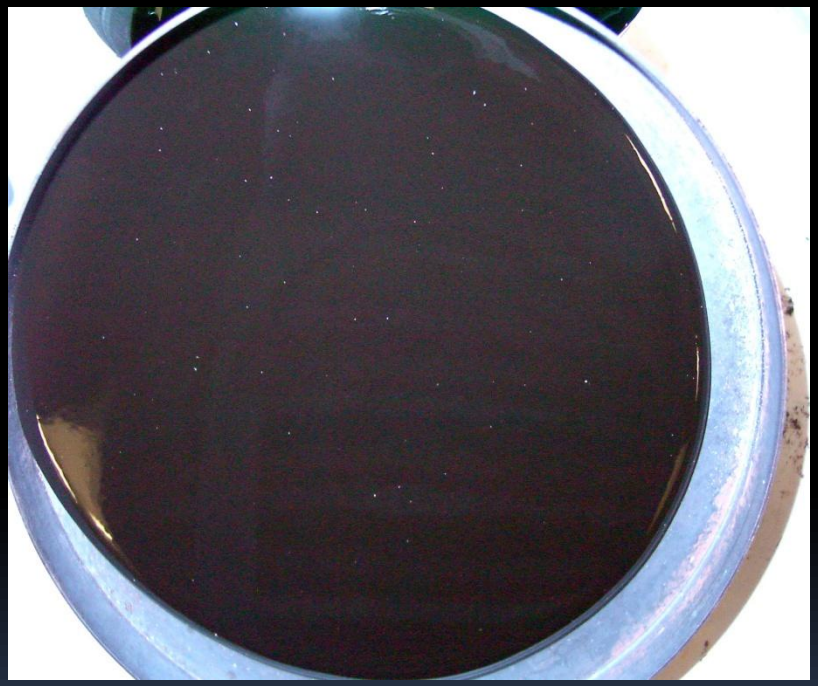




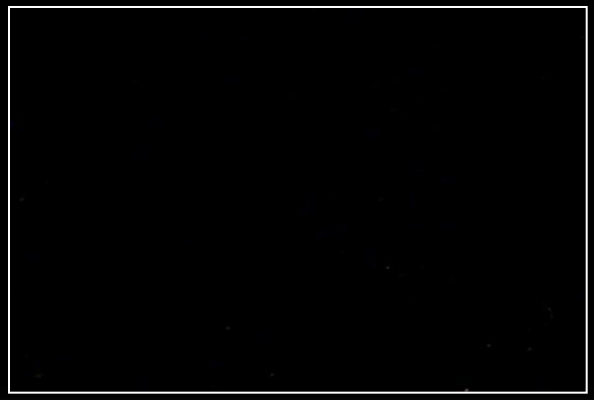
20% CRM
FIELD SAMPLE

WORKABILITY

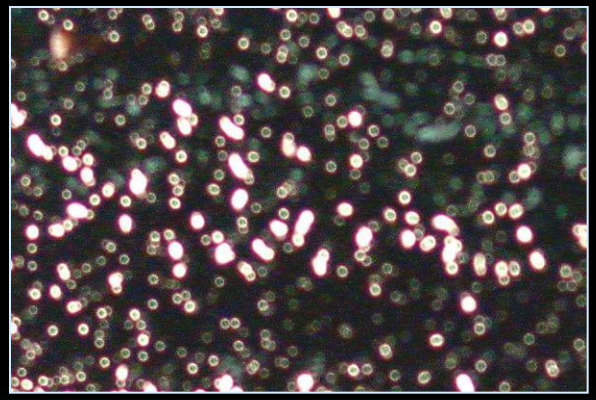
Testing Applicability, 10% CRM + 2% SBS



PHYSICAL APPEARANCE (Smoothness)

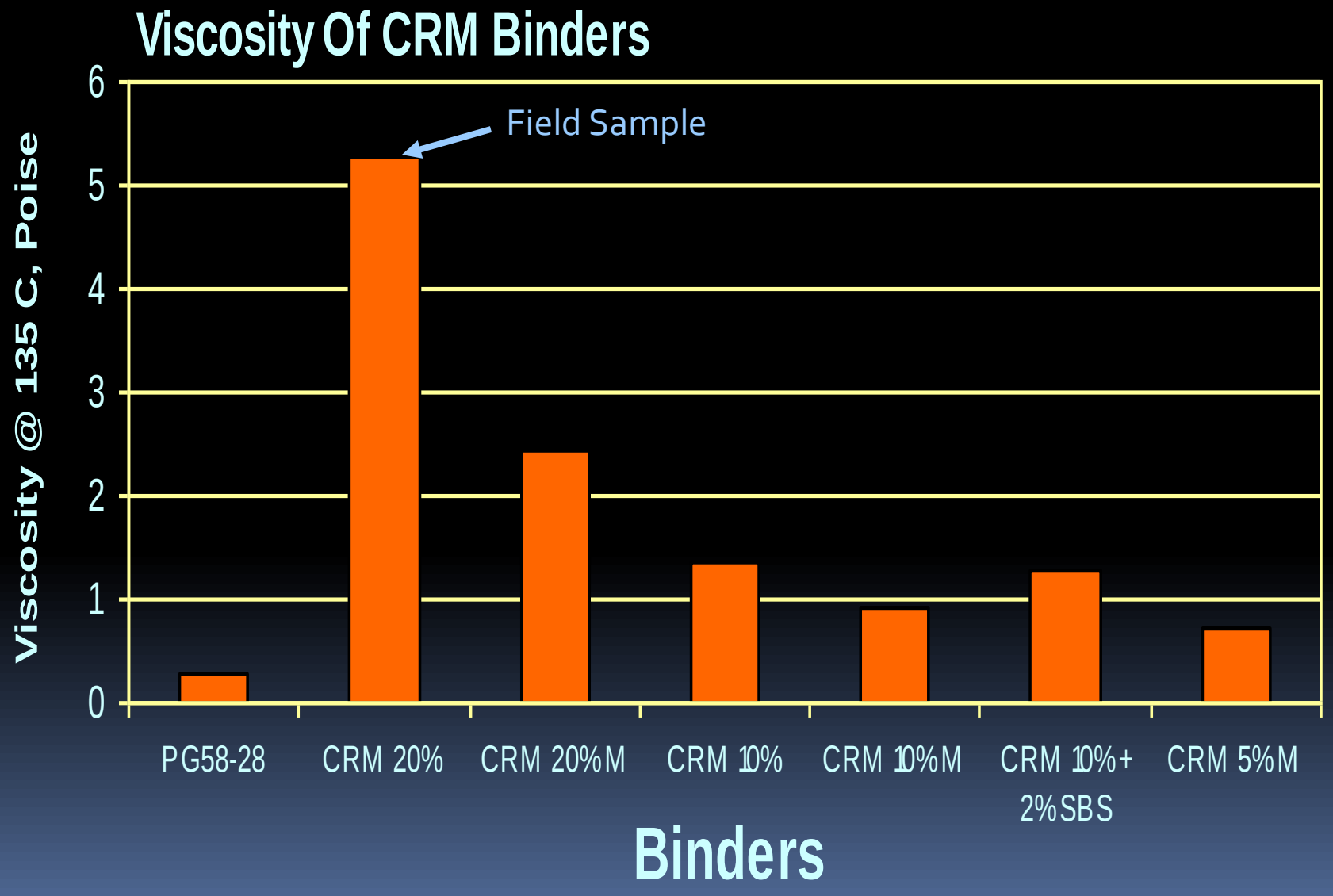


Binder Made of Processed CRM



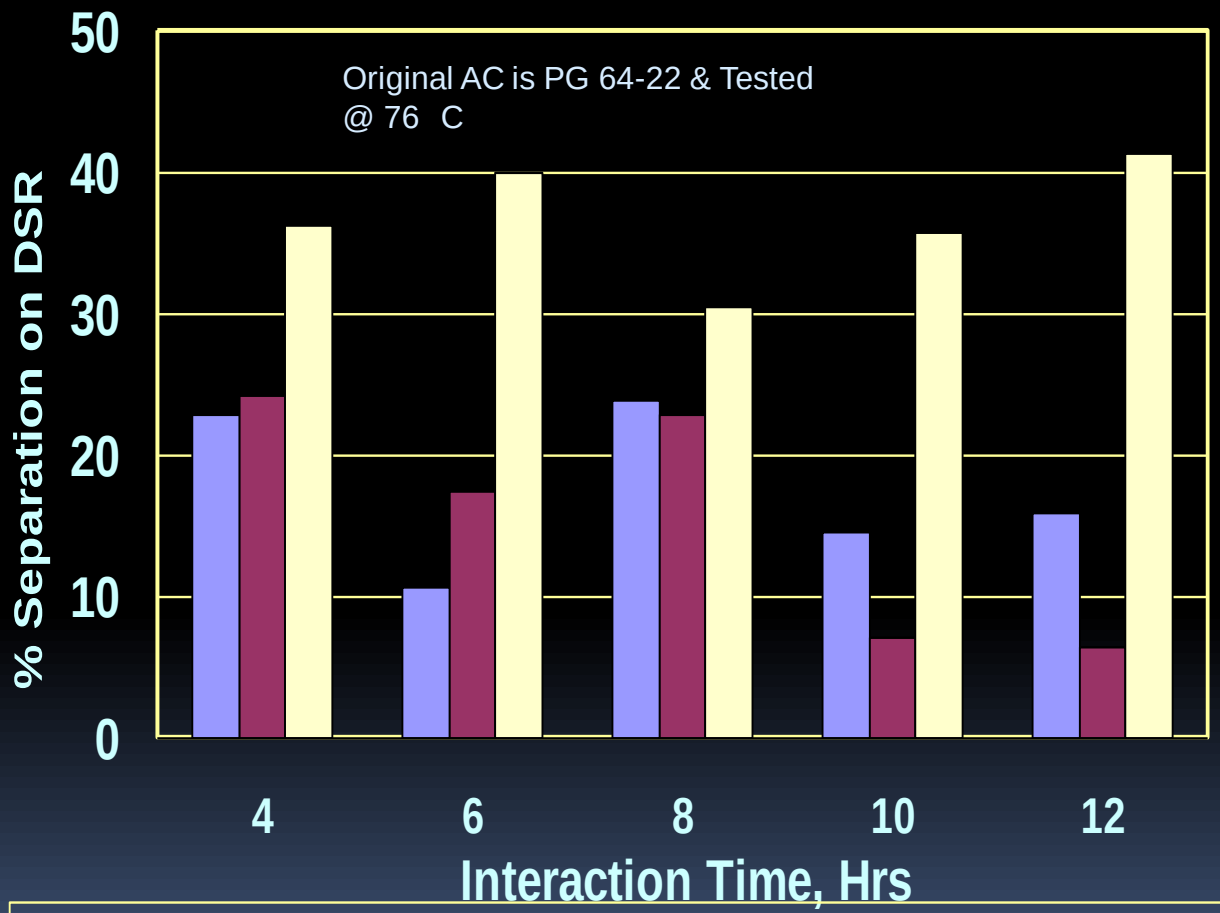
Binder Made of Regular CRM

WORKABILITY



BINDER STABILITY

3.8% Processed CRM Modifier, Mixing Only @ 190 ºC for 12 Hrs



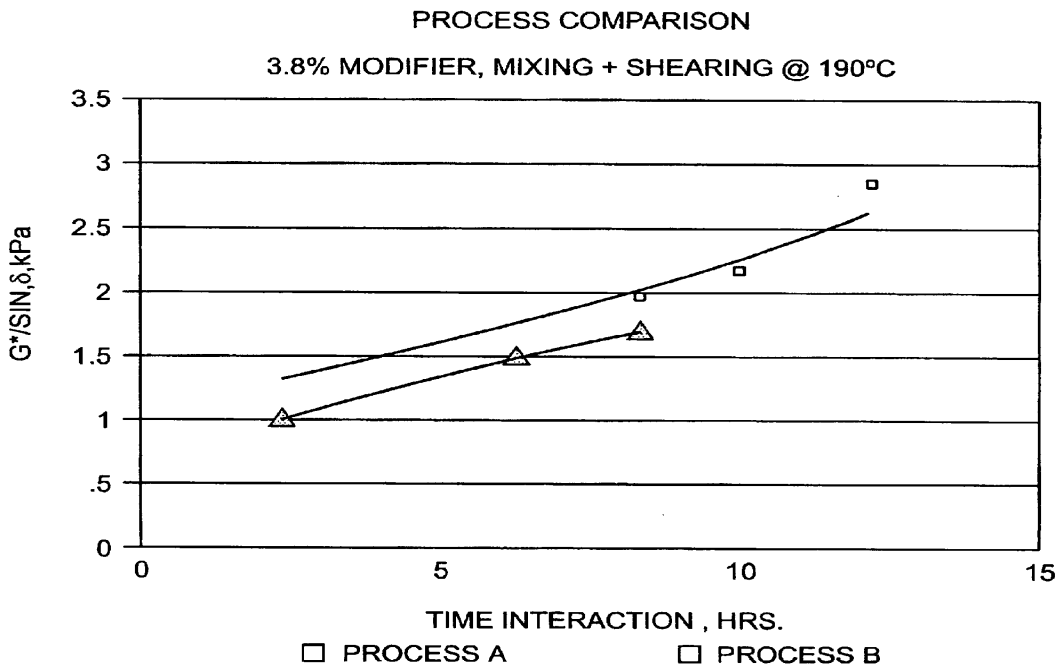

PROCESS COMPARISON
3.8% MODIFIER, MIXING + SHEARING @ 190°C
G*/SIN,δ,kPa
3.5
3
2.5
2
1.5
1
.5
0
0
5
10
15
TIME INTERACTION , HRS.
PROCESS A
PROCESS B

FIG. 23

CONTRIBUTION TO SUSTAINABLE PAVEMENT SOLUTIONS

- The solid waste issue
- Long service life
- Constructability
- Environmental concerns
- Recyclability
- Energy savings

CURRENT GAPS IN KNOWLEDGE

- Material selection- CRM production- Asphalt sources- Additives
- Optimization of the interaction process
- Pre-processing of CRM
- Binder production and quality control- Use of quality measures that indicate interaction and performance
- Physical testing may not be sufficient- Need for chemical analysis
- Applicability of performance testing on CRM binders
- Recyclability of CRM applications

MAIN QUESTIONS

- Chemical characterization
  - Do we understand the chemistry of asphalt-rubber?
  - What methods/techniques to use?
  - The key is to optimize material sources and process variables

- CRM Pre-processing
  - How far rubber pre-processing can help improving binder performance?
  - What about the use of pre-processed rubber in the dry process

MAIN QUESTIONS

- Environmental Aspects of Rubber Recycling
  - Binder Production
  - Use of additives, long-term leaching
- Energy Savings
  - How to reduce interaction temperature/time?
  - Explore more economical production methods.

Again..

Crumb rubber, as an asphalt modifier, should be considered based on performance.

Funding should be directed to making better rubber modifiers, using better technologies.

ONE MORE QUESTION

- I think there is a need for a fundamental change in the way we use crumb rubber in pavement.
    - Regulations
    - Advanced technologies that allow new regulations implemented
    - Practice
    - Best-Value in recycled applications

- **What do you thin?**

Thanks..