

*Establishing a Baseline of
Knowledge (thru 2005) by Reviewing
AI IS-220, "Polyphosphoric Acid
Modification of Asphalt"*

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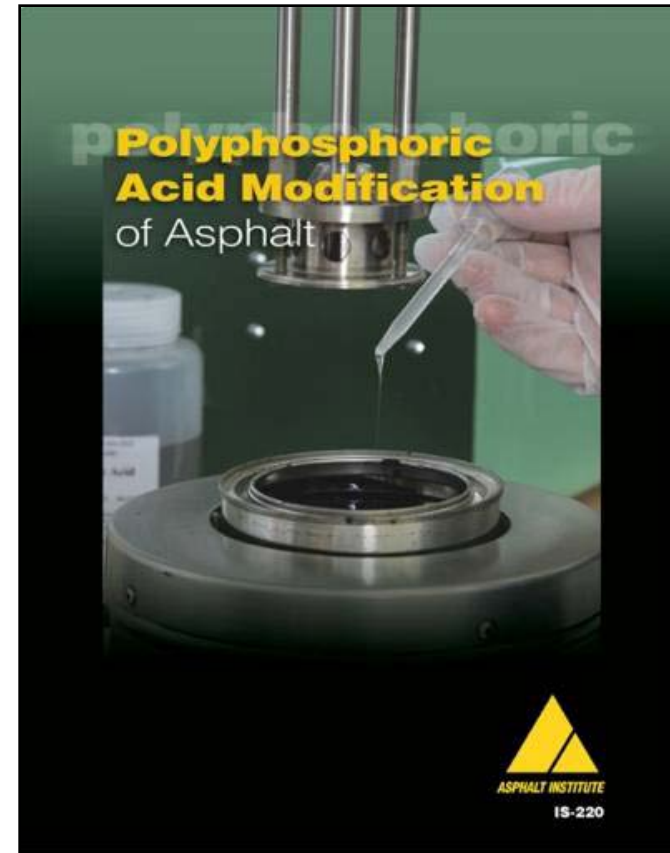


Outline of IS – 220

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asphalt institute

- Introduction
- AI's Position
- What is PPA
- Review of History and Literature
- PPA Modification in Asphalt
- FAQs
- Recommended Practices and Testing



Introduction

(in IS – 220)

- Purpose: Clarify issues regarding PPA modification and to help agencies make informed decisions
- Not a promotional piece
- Developed through AI's Technical Advisory Committee and Affiliate Committee by member reps



AI's Position on Modification and PPA

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- Continue developing performance-related specs
- **Test modified binder after all additions**



Trivia Question?

- Another name for PPA besides polyphosphoric acid???



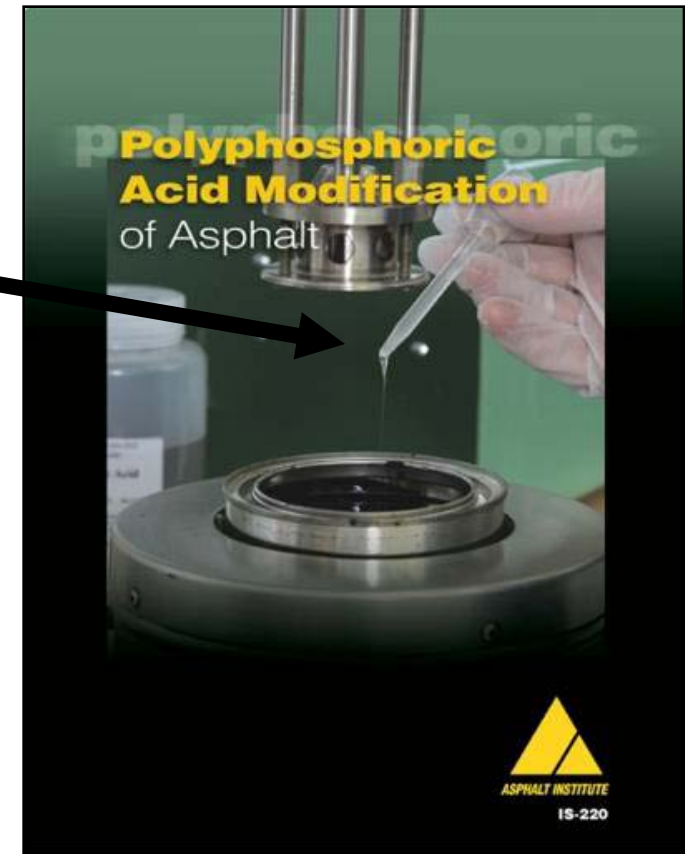
Trivia Question?

- Another name for PPA besides polyphosphoric acid???
- Answer: purified phosphoric acid, which is an orthophosphoric acid and not recommended for asphalt modification



What is PPA?

- NOT purified phosphoric acid or orthophosphoric acid
- Is a liquid mineral polymer



What is PPA?

- Used industrially for its dehydrating and catalytic properties
- Major Applications
 - Surfactant production
 - Water treatment
 - Pharmaceutical synthesis
 - Pigment production
 - Flame proofing
 - Metal finishing
 - Asphalt modification



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 - $H_{n+2}P_nO_{3n+1}$ versus H_3PO_4
 - Different CAS numbers (unique chemical identifier)
 - PPA has greater density and higher viscosity
 - PPA has no free water while Ortho Acid has 15% water
 - Total miscibility (mixing ability) with asphalt
 - Significantly lower corrosivity for steel and stainless steel



Review of History and Literature (through July, 2005)

- Seven Patents found on PPA Modification of Asphalt
 - 1973
 - Chemically modified asphalt
 - 1999 - 2002 (Five Patents)
 - Polymer modified asphalt
 - 2004
 - Crumb rubber modified asphalt



Review of History and Literature (through July, 2005)

- Eight published papers between 2001 and 2005 synopsisized in IS-220
- Presentations during same timeframe are also summarized
- Conclusions that follow are based on these



PPA Modification in Asphalt

- PPA can be effective and economical tool for chemical modification, used alone or in conjunction with a polymer
- PPA can improve high-temp PG grade, and with some asphalt sources may slightly improve low-temp PG grade
- Does not oxidize asphalt or lower m-value
- Two main chemical reactions
 - Phosphate ester formation (irreversible reaction)
 - Acid-basic neutralization (partially reversible)



PPA Modification in Asphalt

- When used with polymer, PPA provides flexibility in reaching specified DSR and ER criteria while limiting viscosity increase @ 275°F
- For acidic aggregates such as granite, PPA can enhance moisture resistance of mix to where an anti-strip may not be necessary
- When an antistrip additive is used, a neutralization reaction may occur (depends of nature of asphalt, aggregate and antistrip). If so, then a partial loss of binder stiffness will result without loss of adhesion properties



Frequently Asked Questions

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Q: Are there antistrips that will interfere with PPA modification?

A: Yes. Under certain conditions, PPA may react with certain antistrips leading to partial decrease of high-temp PG improvement from PPA modification. Antistrip function is not inhibited. Correct formulation necessary.



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Q: Is there a type of antistriper that can be used with PPA modified binder that will not inhibit gains from PPA?

A: Yes. Phosphate esters don't react with PPA. They are effective antistrippers in both neat and PPA modified binders.



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Q: Are there storage or corrosive issues with PPA binders?

A: No. PPA totally miscible in asphalt and should not separate. Also, no difference in corrosivity between neat asphalts versus those with 1-2% PPA. Raw PPA is corrosive however.



Recommended Practices by Manufacturers

- Asphalt manufacturers using PPA must do so responsibly:
 - Careful formulation to ensure appropriate dosage based on type of asphalt
 - Ensure compatibility with antistripping additives
 - Good communication with contractor regarding potential use of amine-based antistripping
 - PPA as a raw material is corrosive, so follow MSDS info.



Recommended Testing by Agencies

- Specifiers and agencies can help ensure responsible use of PPA by conducting:
 - PG Plus binder test (i.e. ER) to ensure presence of polymer when one is required
 - DSR testing to check for compatibility of PPA with amine-based antistrips before and after antistrip is added.
 - Mix performance tests to evaluate moisture susceptibility (T-283, wheel tracking under water) with all additives included.



Final Thought

- In the next day and a half, it will be interesting to observe:
 - How far we have come in the last 4 years in furthering our knowledge of PPA modification of asphalt
 - How many of the issues and questions on this topic that existed 4 years ago are still present today



Current AI Members, April 2009

MEMBER COMPANIES



AFFILIATE MEMBERS



Questions?

Reminder: I'm not a chemist

