

# UNH Materials Science Seminar

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DeMeritt Hall 209B

University of New Hampshire

## Paving Using Latex Modified Asphalt Emulsion: View from the Colloid Scientist

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Modified asphalt emulsion with the latex polymer is not an emulsion of polymer-modified asphalt; rather an emulsion containing dispersed latex particles in the aqueous phase. Menisci of water containing latex particles form among asphalt droplets when water starts to evaporate from the bitumen emulsion. The latex particles migrate together with water, accumulate in the menisci and form the honeycomb structure surrounding the bitumen droplets. This honeycomb is highly elastic with high elongation even at below  $-30^{\circ}\text{C}$  and maintains its strength at elevated temperature of above  $80^{\circ}\text{C}$ , because of high molecular mass and low glass transition temperature of the latex polymer used. In contrast, a typical unmodified asphalt binder remains its desirable physical properties only at a narrow temperature range of  $10\text{-}60^{\circ}\text{C}$ . It is too brittle at low temperature and has limited strength at  $>60^{\circ}\text{C}$ .

A pillow composed of the latex foam would be another example of composite material taking the maximum advantage of two distinctly different physical properties. Air in the foam provides the desired softness and strength is gained from the polymer network. If the same polymer were dispersed in air instead of forming the polymer network, it would simply be a polymer aerosol with no physical strength. Latex polymer modified asphalt is similar to the latex foam. Instead of "softness" from air, the asphalt provides "hardness" required as a binder for aggregates. Improved elasticity and strength are gained through the polymer network formation. A new Dynamic Shear Rheometry (DSR) procedure was developed to evaluate the strength of the asphalt emulsion residue under repeated high-strain deformation. Results demonstrate that the latex modified residue withstands repeated high stress-strain cycles, similar to stresses generated by fully loaded radial truck tires and snowplow operation. You can imagine tiny latex foam pillow supporting each aggregate for your safety and comfort as you drive on the asphalt pavement.