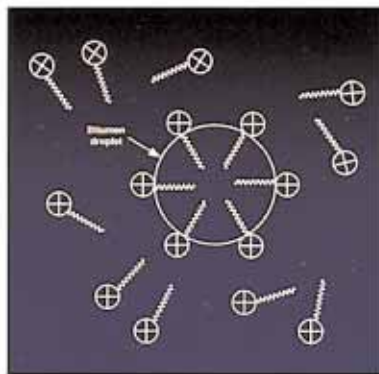


Chemistry holds the key

A long running Nynas development programme is building on the company's well established expertise in emulsion technology.

"A lot of our work... has been carried out in partnership with customers with their products and desired markets in mind," says Dennis Day.

Research and development work on emulsion technology by bitumen specialist Nynas has resulted in increased performance in the growing surface dressing market and also enabled new technologies to prosper. Cold lay surfacing and cold mix recycling are two areas of asphalt technology that have prospered greatly in recent times with the aid of high tech bespoke



A bitumen droplet in suspension, stabilised by emulsifier molecules.

bitumen emulsions developed by Nynas (see box).

Emulsions are manufactured by suspending bitumen in water with an emulsifying agent for stability during storage. When the emulsion is being used as a surface dressing or cold mix binder, the material is designed to 'break' rapidly at the point of application leaving the water to evaporate and the bitumen particles to coalesce and cure.

These conflicting requirements set the parameters for emulsion

design, manufacture and use. Stability is required to enable storage and workability right up until the breaking process is activated by the chemistry of the emulsion coming in contact with the aggregate or the substrate and the mechanics of compaction forces.

"There are differences between bituminous emulsions used for surface treatment and those for cold mix/cold lay materials because the application processes are quite different," says Nynas quality and development manager Chris Southwell.

"Surface dressing emulsions are designed to exhibit a rapid set so the resurfaced road can be reopened and trafficked quickly, whereas storage capability is desirable for most cold lay applications. Stability is preferred in place of fast curing and the emulsion must be finer to ensure all of the aggregate is adequately coated.

"But it isn't as black and white as it seems. For example, emulsions for slurry seals and micro asphalt overlays, which are mixed cold on site, need to be very stable in storage yet a fairly rapid set is also required. Our development work has centred on optimising the chemistry of emulsion design to provide the best material for each particular application," says Southwell.

Although surface dressing is the more traditional use for bitumen emulsions, Nynas' development work on materials for cold lay/cold mix applications dates back some 8 years to the Streetworks Act of 1991, says Nynas development chemist Dennis Day.

"The 1991 Streetworks Act called for footpath and carriage-way reinstatement systems with storage capability that could be



laid in a single pass and perform as well as hot mix materials. Cold lay materials were already in widespread use in other countries, particularly in North America where construction sites can be far away from the nearest asphalt plant, but in the UK where the opposite is generally true, there had been very little call for this technology.

"However, fluxed mix trench reinstatements tend to settle or fail prematurely and the cost of revisiting sites and the need to be able to store or transport material for long periods led the Highways Authorities & Utilities Committee (HAUC) to lobby for the Streetworks Act."

Laboratory work on cold mix emulsions was given a boost in June 1992, says Day, when HAUC published its Specification for the Reinstatement of Openings in Highways. Appendix A10 of this specification gave added incentive for Nynas and its customers to push on with cold mix/cold lay technology and develop proprietary Permanent Cold lay Surfacing Materials (PCSM).

Furthering the technology

"A lot of our work on bitumen emulsions has been carried out in partnership with our customers to further the technology with their products and desired markets in mind," says Day.

"It would have taken a lot longer to get to where we are

today if we had worked on our own to develop a range of emulsions to suit cold mix applications. Emulsions perform better if they are designed to suit a customer's specific aggregates or application and this is how the technology has developed – with bespoke formulations designed to provide the optimum solution."

Nynas has continued to develop and improve its surface dressing emulsions while work has progressed to develop cold mix/cold lay technology. What has always been recognised as a cost-effective method of restoring road surface characteristics has been improved to provide benefits in terms of performance, says Day.

Chemistry reformulated

"The chemistry of our surface dressing systems has been reformulated to do a specific job on site, to provide a more rapid break and faster cohesion to allow trafficking even earlier.

"This is being achieved particularly well by our polymer modified emulsions, which provide greater early life performance and a longer overall design life by increasing the cohesion between binder and chippings," he adds.

These developments in emulsion technology – for hot and cold mix applications – have been helped by the introduction of performance based asphalt and surface dressing specifications. Trials are being carried out up and down the country as companies work to gain Highways Agency or local authority approval of new products and surface treatments.

"Surface dressing has not been favoured for hard wearing or heavily trafficked roads in the past due to problems caused by lack of consistency and premature brittle failure in cold weather," says Day. "However, better materials that can perform well in onerous conditions are

Nynas has developed bitumen emulsions for Bardon Aggregates' Haucphalt Permanent Cold lay Surfacing Material (PCSM) and Tarmac's StreetMaster PCSM wearing course. Haucphalt uses recycled aggregate with a Nynas emulsion to provide a trench and full width pavement reconstruction material for cycleways and Class 3 and 4 roads. A polymer modified cold lay thin surfacing has also been trialled on a trunk road in England under a joint project between Tarmac and Nynas. Both Tarmac and Bardon

now have full HAUC approval for their PCSM products. The Landrec joint venture between Bardon's parent company Aggregate Industries and AEA Technology is perhaps the most vivid example of the environmental benefits that have come about through cold mix technology. The Landrec process recycles and neutralises contaminated granular brownfield or blackfield waste by mixing it with a specially formulated bitumen emulsion for use as a road building material.

now being produced through polymer modification and advanced spraying systems have been developed to give greater control over application of the binder.

"Our sales managers have reported significant increases in quantities of emulsion supplied for surface dressing over the last three years as confidence in the performance of the material has grown," adds Day.

The progress made in improving the performance of surface dressing systems has been recognised by the Highways Agency, which has effectively approved their use for high speed sites by adding a new performance related clause in its Specification for Highways Works.

"Clause 922 of the specification relates to surface dressing systems for high stress sites and trunk roads," says Day. "It has

been written into many HA contracts over the last two years since it was introduced. The clause introduces performance tests such as cohesion into the specification, which now requires greater attention to design and production."

What really satisfies the customer is the quality and performance of the end product, says Day. Nynas is able to provide good results because its crude oil source in Venezuela enables the company to manufacture very consistent high quality bitumen. Nynas has also invested heavily in quality control using advanced analysis techniques at its Eastham and Dundee refineries.

"There is no substitute for visiting a customer's site to determine the specific surface and environmental conditions of each site for consideration in the emulsion design," adds Day.

Advances in Nynas' emulsion technology have greatly boosted the performance and reputation of surface dressing.

