Improving asphalt road pavement with nano-engineered particles

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Warm mix asphalt (WMA) is gaining attention in the asphalt industry as an eco-friendly and sustainable technology.

WMA reduces energy consumption while simultaneously minimizing vapors and greenhouse gas emissions during the production of asphalt mixtures in comparison to conventional asphalt. However, high moisture susceptibility and aging of asphalt make WMA less durable on the roads.

To address both issues in WMA technology, a team from the Energy Safety Research Institute (ESRI) at Swansea University and Braunschweig Pavement Engineering Center (ISBS) at the Technical University of Braunschweig have discovered potential for fumed silica nanoparticles (FSNs) to be used as an anti-aging binder that can not only serve to reduce temperature but also significantly overcome limitations caused by moisture susceptibility.

Lead researcher Goshtasp Cheraghian said: "The presented research covers existing gaps in WMA technology. FSNs with large surface area are ideal candidate as a cost-effective and non-toxic materials which can meaningfully impact on shielding asphalt in WMA technology. In addition, our findings on the concept of the molecular interaction between nanoparticle and asphalt binders can open new avenues for the application of nanotechnology in asphalt engineering."

"It's possible that someday these high surface area NPs will be used in the asphalt and build longer-lasting roadways by minimizing asphalt-related emissions (VOC and CO_2) in real world conditions." Sajad Kiani says.

Professor Andrew Barron, the Founder and Director of ESRI and the Sêr Cymru Chair of Low Carbon Energy and Environment at Swansea University, said: "Reducing energy and resources is a key goal of ESRI and vital for industry as it moved towards Net Zero."

The article can be read in *Scientific Reports*.

More information: Goshtasp Cheraghian et al, Rheological, physicochemical, and microstructural properties of asphalt binder modified by fumed silica nanoparticles, *Scientific Reports* (2021). DOI: 10.1038/s41598-021-90620-w

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