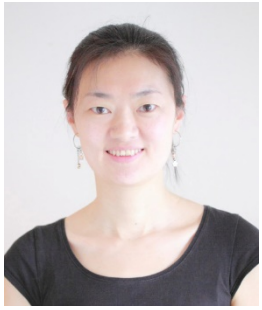
Cracking the problem of ice build-up



If you've ever set foot on an icy pavement you'll understand the importance of a good de-icer.

But ice doesn't just get in the way of people's daily lives. Infrastructure like aircraft, transmission cables, and offshore oil platforms can all be disrupted by ice, with potentially disastrous consequences.

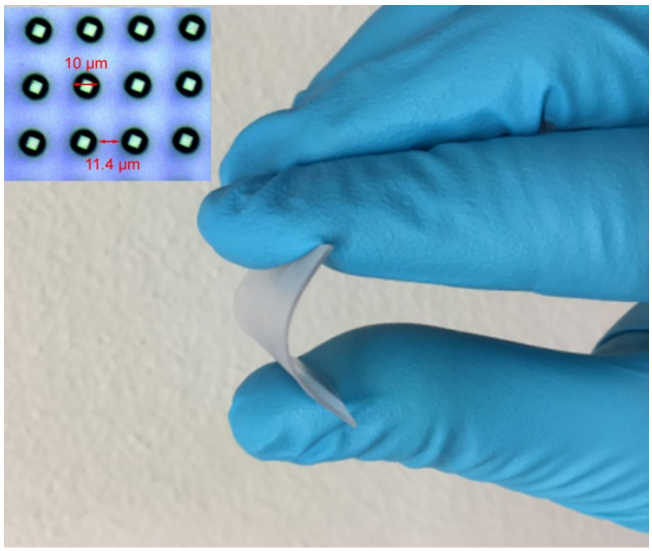
That's why Jianying He, a professor of nanomechanics at NTNU, and her colleagues are coming up with new ways to crack the problem of ice build-up.

"Nobody wants to go out in the winter to clean away ice, so we need to find a solution to avoid ice forming on the surface," says He.

We used to think that the best way to tackle ice was to make surfaces repel water – the idea being that if water can't build up, it can't freeze – but it turns out that just slows down the formation of ice, and doesn't stop it entirely.

So He and her colleagues decided to try another tactic: they'd let the ice form, but find a way to get rid of it afterwards.

The most promising method works by creating lots of cracks that make the ice break off from the surface of its own accord. It's similar to how the perforations between postage stamps make it easier to tear them apart.



Inner hole contained flexible and transparent icephobic coating

The method – called the macro-crack initiator, or MACI – involves applying a soft layer with inner holes on top of the surface you want to protect from ice. The soft layer fluctuates as ice forms on top of it, triggering lots of small cracks. This leads to whole layers of ice shearing off from the surface under their own weight.

"Ice itself is rigid," says He. "Usually it moves like a whole piece."

MACI is working remarkably well, she says, reducing the ice adhesion – a measure of how much the ice is stuck to the surface – even more than the team thought it would.

The next step is improving the durability of the material. Materials with lower ice adhesion are typically softer. To counter the loss in durability that comes from this softness, the group have designed a self-healing elastomer that works to fix any damage to the material.

Their coatings are not in use outside of the lab yet, but He doesn't think it will be too long before they are. At the moment they could be used on something small, she says, say a webcam that's exposed to the environment.

But after some more characterisation work – and some field tests – they could be coming to an oil platform or aircraft near you.

Kelly Oaks, May 2019