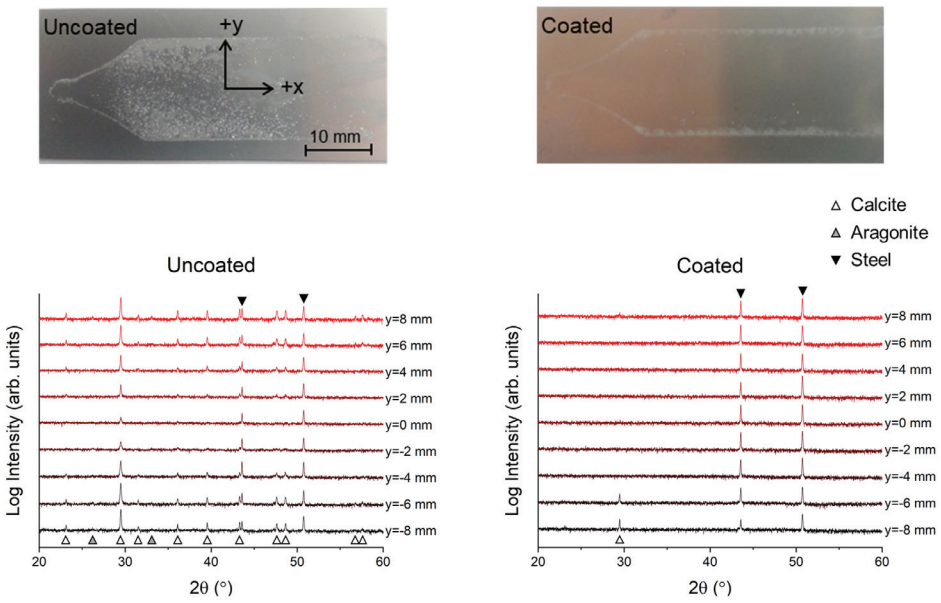
MINERAL FORMATION IN HEAT EXCHANGERS

The overall system efficiency of water-based heat exchangers is influenced by the control and handling of unwanted mineral formation (also known as "inorganic fouling"). Researchers from Aarhus University collaborated with Grundfos to investigate mineral formation and the impact of anti-fouling coatings in an accelerated heat exchanger environment.

Heat exchangers pass heat from one medium to another without the two media mixing. A heat exchanger is a closed system and cannot be cleaned easily. Finding ways to mitigate mineral formation in water-based heat exchangers, such as efficient anti-fouling surface modifications, which may improve the efficiency and lifetime of heat exchangers is thus important.



Upper: Selected steel surfaces after 40 hours exposure in an accelerated heat exchanger environment. Lower: Corresponding X-ray diffraction patterns collected at a fixed x position in steps along y

The X-ray diffraction studies at Aarhus University enabled the identification of fouling minerals across steel surfaces from an accelerated heat exchanger environment and provided insights into the effects of anti-fouling coatings.

KEY ACTIVITIES

- Grundfos provided coated and uncoated steel samples exposed to a simulated heat exchanger environment. Two different anti-fouling coatings were investigated.
- X-ray diffraction studies were performed at Aarhus University, Dept. of Chemistry and iNANO.
- Scanning mode X-ray diffraction was used to examine inorganic fouling across the steel surfaces in steps along x and y.
- Peak matching analysis was carried out on the X-ray diffraction data in order to identify fouling minerals (calcite and aragonite) across the steel surfaces.

"The results from this LINX project helped to demonstrate the coatings' ability to delay the development of the hard-to-remove Calcite species. This information will ultimately allow us to design the heat exchangers towards improved overall system performance."

Allan Hjarbæk Holm,
Chief Specialist, Grundfos

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In the LINX project, researchers at leading Danish universities collaborate with scientists in industry to solve industry relevant problems using advanced neutron and X-ray techniques. The group of Bo Brummerstedt Iversen at Aarhus University contributes with their expertise in materials crystallography and diffraction techniques. The LINX Project has received funding from Innovation Fund Denmark (IFD).

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