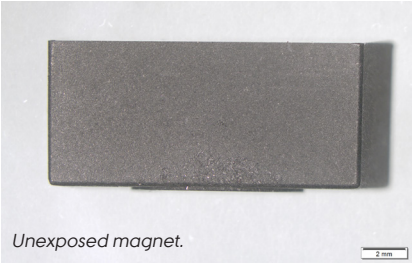
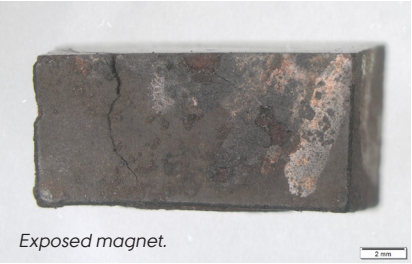
DEGRADATION OF **PERMANENT MAGNETS**

The durability of magnets used in permanent magnet motor technology is important for the long-term performance of products. Researchers from Aarhus University collaborated with Grundfos to study the degradation of permanent magnets in aqueous media at elevated temperatures.

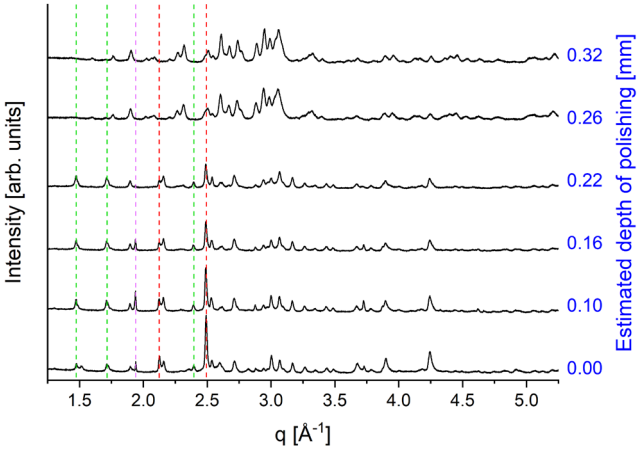
Rare earth permanent magnets are crucial for many electric, electronic and electromechanical devices, but their poor degradation resistance is a major impediment to their use in many applications. Understanding how the degradation products develop in these materials may help determine a method to improve the design and lifetime.



Unexposed magnet.



Exposed magnet.



Upper: *Non-exposed magnet and a magnet that has been exposed to 65°C water for 10.000 hours.*
Lower: *X-ray diffraction patterns collected from the surface of the exposed bulk magnet at different polishing depths. The green, red and purple dotted lines represent positions of diffraction peaks from different degradation products.*

From the X-ray diffraction studies at Aarhus University, a method for estimating the degradation depth of the magnets was developed and degradation phases were identified for selected samples.

KEY ACTIVITIES

- Grundfos provided injection molded NdFeB type bulk magnets unexposed and exposed to water at different temperatures to be examined and compared.
- X-ray diffraction studies were performed at Aarhus University, Dept. of Chemistry and iNANO in order to identify degradation products and to develop a method for estimating the degradation depth in the magnets.
- A method for estimating the degradation depth in the magnets was developed which is based on repeatedly polishing and measuring diffraction data on the polished surface until no degradation phases could be identified.

"Degradation of NdFeB magnets is a very pain point in wet applications. The study gave us a clear indication how they can be protected without hermitically sealing"

BADRINATH VELURI, 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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