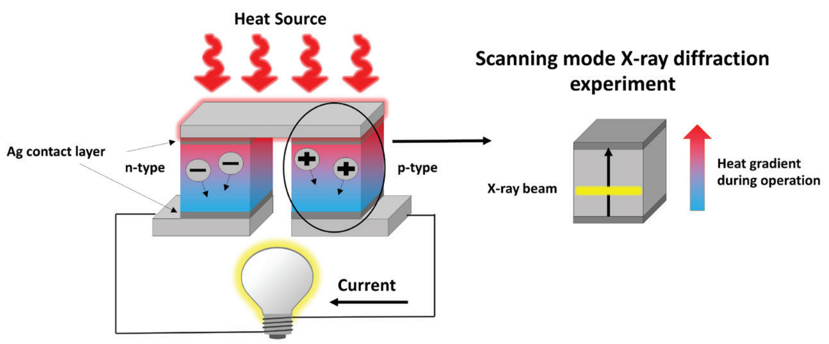
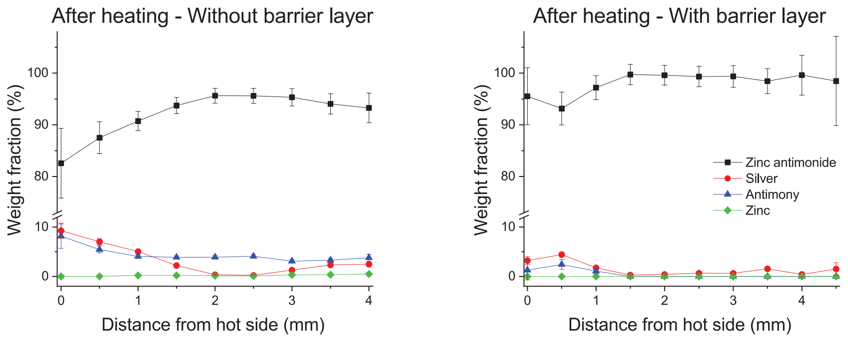
DEGRADATION OF THERMOELECTRIC MATERIALS IN HOT ENVIRONMENTS

Evaluating the long-term stability and performance of materials working at high temperatures is essential in order to assess and improve product lifetimes. Researchers from Aarhus University collaborated with TEGnology to study degradation of thermoelectric materials operating under large temperature gradients.

Thermoelectric materials can be employed in modules to generate a current from a heat gradient. The long-term stability of the materials in hot environments and under large temperature gradients is, however, a major challenge in this field. TEGnology, a company developing a thermoelectric module with new materials, was particularly interested in investigating the possible migration of elements between the interfaces and mitigating migration by introducing barrier layers.



Left: *Schematic of a functioning thermoelectric module*
Right: *X-ray diffraction scanning direction*



Distribution of identified crystalline compounds across thermoelectric module materials: obtained from Rietveld analysis of X-ray diffraction data

The X-ray diffraction studies at Aarhus University indicate that the silver contact layer migrates into the active zinc antimonide material at the hot end under a temperature gradient. From these studies, inserting a barrier layer appears to reduce the unwanted silver migration.

KEY ACTIVITIES

- TEGnology provided samples of active materials from a thermoelectric module before and after exposure to a heat gradient simulating operating conditions.
- X-ray diffraction studies were performed at Aarhus University, Dept. of Chemistry and iNANO.
- Scanning mode X-ray diffraction was applied to examine the active materials along the direction of the heat gradient.
- Rietveld analysis of the X-ray diffraction data provided the distributions of identified crystalline compounds across the materials.

"The work performed in this LINX project provides us a deep insight of our product and leads to a unique solution to improve the reliability."

Hao Yin, CTO, TEGnology

READ MORE
linxproject.dk
CONTACT
materials@chem.au.dk

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).