

Polymers in nuclear applications 2019 - Minutes of the meeting

This document contains a summary on the discussions had during the “Polymers in nuclear applications 2019” seminar, held in 27-28th November at Fortum head office, Keilalahdentie 2-4, Espoo, Finland. The seminar agenda can be found in the end of the document.

Day 1:

- The role and amount of fillers were discussed. It was stated that between different material batches the amount of fillers may be different.
- The first results of SAMPO project were presented and the role of different additives in the ageing of polymers discussed. It was noted that some of the colorants used in polymer might have role in the ageing process as they may have similar properties as antioxidants.
- Qualification of different type of components (valve, water tank and Teflon tube) were presented. It was emphasized that the functionality of the component is important in environmental qualification.
- An idea to cast an ageing sensor within polymer was presented.
- The use of lifetime prediction models were generally discussed.

Day 2:

- COMSY as polymer ageing management tool was discussed. In the European project Team Cables, a virtual ageing model for XLPE cable insulator is developed and it can be included as part of COMSY.
- It was discussed what is the role of fillers in crack initiation of polymers. It was noted that it is currently unclear how the filler adhesion to the polymer matrix affects to the crack initiation.
- There was interest towards Team Cables project how the results of the project results are disseminated. Several peer reviewed publications will be produced by the project and as published there are no limitations on their availability.
- The state of the art of condition monitoring techniques on cables was presented by Sue Burnay. EPRI 1003663 report has several good practical examples on different ageing issues. The use of DSC in condition monitoring was discussed in more detail after Sue’s presentation and it was stated that OIT could be used as an “early warning” method for polymers (although the temperature should be set according to a reference temperature, 60 minutes as an example).
- In the miniworkshop participants were divided in small groups and different tasks related to SAMPO project topics were given to the participants to be discussed. The following summary on the discussions during the workshop could be made:
 - When the relevance of studying O-rings and their ageing was discussed, it came up that also membranes would be an interesting research topic.
 - There is not much information available on the polymer composition or even the material properties as they are purchased. The role of REACH and legislation in prohibiting the use of additives is known, the issue is that how early stage it is possible to have information if the polymer product’s additives are going to be banned and then changed.
 - The failure mechanisms for O-rings were discussed and how to test them properly for tightness.
 - Good perspectives were provided for online condition monitoring, e.g. there cannot be changes in structures by the online sensor, the sensor should withstand environmental

fluctuations, sensors should be environmentally qualified and possibilities of wireless communication were speculated.

- Fire safety and fire retardants were discussed. It was noted that aluminium hydroxide can decompose already at 130°C.
- Additive manufacturing (AM) was discussed, it was speculated that thermoplastic polyurethans or copolymers would be the most applicable group of polymers that could be manufactured by AM.
- The seminar culminated to presentation from James Walaker where the participants received different type of rubber slabs, which demonstrated how changing the compounding had an effect to the material properties.

Program

November 27th

12.30	Registration and coffee
13.00	Welcome <i>Eero Vesaoja, Fortum Monika Adsten, Energiforsk</i>
13.20	Polymers in nuclear industry - Westinghouse experience <i>Maria Ekelund, Westinghouse Electric Sweden</i>
14.00	SAMPO project – plans and preliminary results <i>Konsta Sipilä, VTT and Jason Ryan, RISE</i>
14.40	Coffee
15.10	Environmental qualification of membranes in isolation valves and evaluation of corrosion protection lining in tanks <i>Stjepan Jagunic, Ringhals</i>
15.50	Possibilities for online monitoring of permittivity changes in ageing polymers <i>Henrik Toss, RISE</i>
16.20	Ageing of elastomer seals for nuclear waste containers - methodology and lifetime prediction <i>Anja Kömmling, BAM</i>
17.00	End of seminar day 1
17.15	Get together and dinner at Fortum office

November 28th

8.30	Nordic cable group <i>Patrik Rydberg, Ringhals</i>
9.00	European Tools and Methodologies for an efficient ageing management of nuclear

	power plant Cables - TeaM Cables <i>Konsta Sipilä, VTT</i>
9.30	State of the art condition monitoring techniques on cables <i>Sue Burnay</i>
10.10	Coffee
10.30	Fire safety and cables (URAN-project) <i>Jukka Vaari, VTT</i>
11.00	I&C accelerated ageing and I&C re-engineering <i>Markus Hartikainen, Fortum</i>
11.30	Lunch
12.30	Mini workshop: What are the challenges with polymeric materials in different nuclear applications and how can we solve them with R&D?
13.30	Coffee
14.00	Additive manufacturing of flexible polymers <i>Emil Johansson, RISE</i>
14.30	Compounding and manufacturing elastomers for use in nuclear applications <i>Andrew Douglas, James Walker</i>
15.15	Wrapping up
15.30	End of seminar