Topic Area 5 Q&A Transcript

Q: For the SiC composite are thermal physical properties, measuring the anisotropic characteristics of the composite of interest since that would be necessary to understand temperatures inside of the cladding?

A: I think that would be a good approach. At Oak Ridge we developed the two MGM device with Doctor Eisenhower back in the day for the TRISO particles. It's very difficult to understand and to look at the anisotropy of the silicon carbide weaving and the monolith and also the CVD. If you can figure out how to use a Mueller matrix to do that, that would be great. It's actually a very difficult problem because you're looking at black on black. When you look at this it looks black and, for instance with the Mueller matrix, you're reflecting light and you're looking at polarization of the light and it tells you how random or how much anisotropy you have. To distinguish this from the TRISO particle, where you have a nice, hopefully round particle is easier, but with the silicon carbide cladding it would be extremely difficult. That's why we are looking at some ideas for that.

Q: When we submit an application and it says create application, I just want to ensure that it's fiscal year 2024 R&D pre-application, is that correct?

A: For this topic area, Topic Area 5, that's correct.

Q: Are graduate students and or part time faculty eligible to be the principal investigator?

A: It depends on your institution's requirements for what a PI is. Most won't allow adjunct professors, for example, to be lead PI. Typically, we see a lead PI is a tenure track faculty member but doesn't have to be, it's going to be based on your university policy.

Q: Is there any consolidated database of industry partners and their contact information?

A: The NEUP site at neup.inl.gov lists past projects and is an excellent way to start finding background information on an area or participants. Another area is a yearly publication by the American Nuclear Society that has the buyer's guide, and in there you can look at the different types of organizations, what their expertise is, and that they actually list the name of the person that you can contact. The buyer's guide is a public document at ANS.gov.

Q: Are you going to publish the emails from the people who participated in the office hours?

A: The slides will be published here and if you have further questions, please email NEUP@inl.gov and we will facilitate those conversations between program managers and yourself?

Q: For the NDE for the silicon carbide cladding, is the development of this NDE technique for hydrothermal corrosion of silica carbide cladding relevant or the general quality control?

A: There's two pieces of it. NDE methods could be used while it's being fabricated but they're not necessarily the same thing as characterization techniques because characterization techniques might mean that you have to destruct the material to look at it.

Q: Is the silicon carbide compatibility with the metallic coolant in fast reactors of interest for the program?

A: It could be, it would have to be tested in terms of its compatibility, it depends what metal coolant you're using.

Q: It seems like there's a focus on the manufacturing process and characterization as opposed to future in service inspection, is that right?

A: You don't do NDE on fuel while it's in the reactor. You could take it out when you refuel after it's been irradiated in the reactor but that would be difficult. If you look at the TRISO fuel approved topical report we're not looking at all the individual particles, we do it statistically. One of the concerns the NRC was asking about was how do you know that the way you made the fuel and the way you tested it in the advanced test reactor how does that resolve itself, how does that perform in reactors? That's why we're looking at NDE and characterization techniques particularly in fabrication because we can't do NDE on each cladding. The Nuclear Regulatory Commission likely will not ask us to do characterization and actual methods of testing out the cladding inside the reactor, they haven't done that even for current zircalloy fuel.

Q: When you're we're thinking about manufacture, are you primarily interested in the raw ingredients, such as the cladding tube itself, or an assembled rod, including ceiling caps and other things?

A: All of it, and that's why we thought you may want to work with our industrial partners because, for instance, GA is looking at cap means and how to keep it sealed so is BWXT and Framatome.

Q: Are you considering U-Pu-Zr, or is uranium zirconium a higher priority because it's more near term? And do you have a preference on solid versus annular design?

A: We are definitely open to U-Pu-Zr, and we see that as being the longer term. If you're, if you're doing a once through design that uses U-Pu-Zr, you've obviously got the dilemma of how to acquire the material and all the problems with that. A lot of the near-term demos and things are using just U-Zr, but we're absolutely open to U-Pu-Zr. Regarding annular, we're very interested in that, we're driven in these once through to try to avoid sodium bonding and driven towards annular fuel. That's mostly a waste and repository or an immediate storage concern. So we are open to annular fuel. For close cycle, we are definitely not ruling out continuing with some kind of bonding, for example sodium bonding. If we get really proficient at annular fuel design because of these one through things then, that could be a great deal to use angular fuel in close cycles. We're not throwing out bonding, we're open to annual fuel in in any mode, unless of course it's way more expensive, or the mechanical tolerances for fitting it are unreasonable.

Q: Are you interested in fundamental studies or more of a applied what's needed in the near term, that will be complementary to the NEEMS effort or the ongoing AFC stuff? Or do you really want to look at more thermodynamics, like constituents, distribution, phases, etc?

A: At higher temperatures you get higher thermal efficiency is what I was really addressing.

Q: Does the statement from the FOA "There has been considerable effort in characterizing and modeling the thermophysical and thermochemical properties of molten salt" imply that salt characterization is not relevant to this topic area? This seems to be the case, as the remainder of the section indicates that proposals on fuel salt production are the main focus of the topic area.

A: That is correct. This topic is more before it gets loaded into the reactor, as well as fuel recycling on the back end.

Q: Would there be any interest in molten salt corrosion of TRISO fuels?

A: It is interesting and please note that Kairos is looking at molten salt coolant. The fuel does not flow with it, we don't have little particles going in, they're fixed pebbles. It is of course it's of interest, but we do have, a couple of NEUP projects that have looked at this. Don't duplicate work and maximize relevance by leveraging industry collaborators. I would do is look at NEUP projects in the past four years. We do have a molten salt test rig, the question is, how does that work if it's just the chemistry. The other question would be the fluence issue, and the temperatures that would be the used. Building a test rig for the corrosion may be very difficult but maybe in an autoclave you could do it. But again, please do not duplicate what's already been done before.

And you know, there are different forms of FLiBe beyond what Kairos is looking at.

So be very careful that you're looking at an appropriate molten salt that doesn't suck up more neutrons than the fuel does. Folks have been looking at, what about a chloride salt? Well, you have to worry about the chloride isotope that has a higher cross section than the uranium does. So be careful which coolant you pick.

And which form of TRISO fuel you pick. It can be in balls, it can be in slugs, the fuel doesn't always come isolated. Or if it’s a TRISO in a SiC composite, perhaps in a SiC block, then you need to make sure that you're not just testing what the fuel would do, but also the compact and the matrix form.

Q: Would the silicon carbide clad control rod be considered under this topic?

A: Silicon Carbide rodlets could be used in various PWR and other ideas. We may want to look at NE 5, the advanced reactor topics because control rods are not fuel. We wouldn’t be particularly looking at that.

Q: Is there any interest in novel / less mature / less technologically-advanced cladding materials, beyond FeCrAl?

A: I think we're always interested advanced material. At least one of our vendors is considering FeCrAl as a more advanced cladding for the future. So again, I think that that could be possible, but you can talk to the labs, various labs have thought about that as part of their work.