Energy Quarterly

News and analysis on materials solutions to energy challenges

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MRS Bulletin

What is the future for nuclear power?

We will be discussing the Fukushima nuclear accident for a long time: the human impact, policy implications, engineering, and science needs. We might look back and accept that the accident heralded a new phase in the development of processes that prevent or mitigate accidents for both existing and future plants. Conversely, this accident may send the re-emergence of nuclear power back into a gradual decline, where countries determine that the additional burdens of safety tip the economic balance. A third possibility is that countries already committed to expansion, such as China and India, will continue with that option while countries ambivalent about nuclear power will turn away. It is too soon to know which outcome will prevail.

It is clear, though, in the very short term progress has slowed or halted. Furthermore, the criteria for extending the life of old reactors will become more demanding. That Fukushima Unit 1 was built 40 years ago while the adjacent reactors of more modern design remain unscathed will not be lost. Combining such a small primary containment volume, steam suppression outside of the containment, and fuel stored high up and adjacent to the reactor would now be unacceptable for new reactors. The positioning of backup generators, making them susceptible to problems caused, for example, by flooding, will also be hotly debated. Globally, regulators will carry out simulations and "stress tests" under compounded severe accidents; these may reveal issues not yet identified. Some reactors may be shut down causing capacity problems. Nevertheless, we will learn from this incident and change processes: even new designs will emerge.

Over the next decade, materials researchers will make a range of contributions to the development of nuclear power, such as safely retiring older reactors and developing new, more efficient nuclear fuels. Gen-IV reactor materials will be optimized for their extreme environments. Of course, over four decades ago, the designers of the Fukushima reactors were faced with equivalent challenges. We might ask ourselves what the Fukushima designers would have needed to know to anticipate and mitigate against the present circumstances. Can we then ask the equivalent questions for today's potential new designs? If so, and we are still satisfied with these designs, we have taken another important step toward a safe and sustainable future with nuclear energy.

Robin W. Grimes

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