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Three-hundred forward

"The *Journal of Nuclear Materials* will initially be published quarterly. It is planned to publish annually a volume of about 360 pages..." So reads a 1959 announcement of the North-Holland publishing company and its editors R.W. Cahn, J.P. Howe, and P. Lacombe. As a matter of comparison, the 2001 program covered some 4032 pages in 12 volumes. With the present issue, some 42 years later, we celebrate the publication of the 300th volume. Evidently, there was something to the bold idea to create a journal in a new field. In these pages an astonishing diversity of physical phenomena have been revealed, characterized, attacked with advanced techniques of theoretical and experimental investigation, and understood mechanistically. Technical issues initially perceived as intractable have been tamed for nuclear technology and documented here. Achievements, high-flying as well as workman-like, have been set out in profusion. It is impressive to realize that the careers of so many scientists and engineers are chronicled herein.

The Journal is the main forum for the publication of results in nuclear materials. Today, the Journal and the field that it represents are closely identified with each other. At the same time the identity of the field has broadened substantially. Initially, many people would have interpreted the words of the Journal title as applying mainly to uranium, plutonium, thorium and materials associated with fuel elements, neutron moderators, and neutron absorbing materials such as zirconium, graphite and boron carbide, in fission reactors. Now we understand the term to cover all classes of materials. The purview of the Journal ranges from the most fundamental aspects of materials science to engineering applications related to fission reactors, fusion reactors and particle accelerators. Atoms displaced by irradiation have required investigations into the solid-state physics of defected structures. On the other end of the length scale, tests to determine the wholesale changes in mechanical properties that follow from the displacement of atoms require brutish hydraulic machines.

The topics of corrosion and thermodynamics of nuclear materials, fuels and fuel elements have been built on the pages of the Journal. Other examples include basic knowledge of defects and diffusion, theoretical and computational techniques down to the scale of atom movements, and development of highly specialized materials such as those for storing and immobilizing nuclear waste. In these pages radiation materials science has been developed and shown to be a powerful asset of the parent field of materials science and engineering, holding conceptually a somewhat similar relation as radiation chemistry to its parent field. Radiation materials science covers interactions of particles with atoms on sub-nanometer length scales, and sub-picosecond time scales, through microstructural evolution at mesoscales, to characteristically strong changes in macroscopic properties developing over the course of years. Changes in the expected performance of large structures, such as fission reactor pressure vessels, core components, and fusion reactor blankets result. Continuing spin-off contributions to advanced materials for aggressive environments in areas removed from nuclear technology are contained in each volume.

Irradiation is the signature of the field covered by the Journal. It often produces detrimental changes in properties and behavior that must be understood and defeated by materials research or dealt with in technological systems. At the same time irradiation offers a powerful method with which to understand and manipulate structure and properties. It is difficult to find any behaviors, properties or structures of materials that cannot be affected by irradiation. In this way irradiation can be viewed more as a generalized dimension or degree of freedom in materials science, say like temperature, rather than as an isolated and specialized subtopic. This is doubtless one of the factors that has made the Journal a source of interest to readers who work outside the expected topical areas.

I invite readers to add a personal selection of observations, trends and changes from the inception of the Journal to the beginning of the new century:

- Now, the Journal is the main forum for publication in the field. Then, publications in the field were widely scattered.
- Then, a computer was a severely limited apparatus without meaning or use to most people. Now, intensive computation is mainstream, bridging theory and experiment, making bold predictions for detailed experiments and inviting confirmations in laboratories made of concrete, steel and wood.
- Then, one would think of a manuscript as being crafted with a pen. Now we imagine everyone tapping

at keyboards, as I am doing now. We ask for an electronic copy of the manuscript for publication. In 1959 what would the imagination have made of the term electronic copy?

- Now, we receive manuscripts from about three-dozen countries. Then, contributions were limited to relatively few countries. Some had not submitted manuscripts until the 1990s.
- Then, there was a much wider range of fission reactor concepts being pursued. Now, ideas for Generation IV reactors again exhibit many new and unconventional designs. In the intervening years research and development focused on relatively few systems.
- The capabilities that can be secured with the internet continue to amaze. It would take a book length article to compare possibilities with 40 years ago. A clear highlight – archival journals can be accessed at one's desktop in a minute. Searching for articles by a particular author or on a particular topic no longer means spending an afternoon in the library.
- The interval 1959 to 1993 spanned 200 volumes. It has been fewer than 9 years between editorials for the 200th and 300th volumes. Extrapolation reveals that celebratory editorials are destined to become a full time occupation.

The first four decades in the history of nuclear materials research has been secured in these three hundred volumes. The architecture that has been built by so many talented authors is part of the framework of materials science and engineering and supports all nuclear and particle irradiation technologies.

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