PREFACE

Atomic Energy and Electrochemistry

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It goes without saying that the progress of new technologies owes much to improved material and the advance of other related technologies. Reversely, we can say that we often witness the improvement in material and devices by the firm establishment of a certain new technology.

In this case, the influence of this new technology is particularly strong when it is one that is on a considerably high degree of scientific and technological level.

From this point of view, the utilization of atomic energy and the electronics have shown a tremendous progress and development during the past several years.

Although these two fields cannot be discussed on the same level because of their different characteristics, there are at least two points in common with the two.

The first is that both have been guided by organized and systematic scientific theories and their progress have been the result more of the theoretical guidance rather than a mere accumulation of past experiences.

The second point is that both are predominantly dependent on materials that have a high degree of purity, and as a result, they have proved to be a big stimulant to manufacturing techniques of pure material, particularly that of extremely pure metals, and greatly accelerated the improvement and development of such manufacturing techniques.

This characteristic is inseparable from the above-mentioned first point because, first of all, pure materials are produced and then are mixed or combined and utilized following the various dictates of theoretical studies. We can also say that these two points in common characterize the utilization of atomic power and electronics as modern technologies.

Putting aside the question of electronics which we concede owes a major part of its development to past technologies, let us take up the relation of electrochemistry with atomic energy which has created such nation-wide reactions in this country during the past several years. What can be considered first in connection with the utilization of atomic energy is the generation of electricity and other use as a new power source.

Techniques in regard to the generation of electricity through the use of atomic energy are still in progress and it is estimated that it will take about four more years before an atomic power plant capable of producing 150,000 kW of electricity will start operating in Japan. Furthermore, it will be quite in the distant future before the atomic energy will come to comprise a considerable ratio of this country's power output.

The operational temperature of present atomic reactors is only a few hundred degrees Centigrade, which is far below the temperature necessary for thermoelectrochemical pro-

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cesses. There seem to be a lot of difficulties to overcome even before a temperature of 1,000 °C can be available in the reactor.

As regards the problem of radioactive isotopes and the utilization of ionizing radiation, it has been proved by various studies and experiments that radiation does not exert a big direct influence on electrochemical reactions themselves, but that its effects on water, gases and other material indirectly exert influences on such reactions.

Therefore, it may be said that among various utilization of atomic energy it is only radioactive isotopes as tracers, which can be utilized positively in the field of electrochemical industry at present and in a coming few years.

Let us now see what role electrochemistry and its technologies are playing in the progress and development of techniques in the field of atomic energy.

The production of heavy water was started with the electrolytic method as is well known, although today this method seems to have drifted a bit from the main current of heavy water production.

Also, in the refining of uranium, various electrolytic methods are being studied today for the conversion of uranium in a higher oxidation state to that in a lower one.

Among the so-called high-temperature metallurgical methods to be used to recover uranium and plutonium by treating nuclear fuel elements irradiated in atomic reactors, one of the promising ones is the electrolysis with a fused salt bath.

Among other various technical problems in the atomic energy field, important from the electrochemical point of view, are those concerning with the corrosion of metallic material by gases, water or other fluids including molten metals and fused salts, the refining of water and the separation of radioactive isotopes by ion exchange materials, both organic and inorganic.

Particularly in regard to the corrosion of metals, there are so many problems still remaining to be solved that in a certain type atomic reactor under development, the corrosion is the most serious difficulty to overcome. Thus it may not be exaggerative to say that the future development of atomic power reactors depends considerably upon the solving of this problem.

At any rate, from the standpoint of electrochemistry, the time has still not arrived when the atomic energy is directly utilized to it. However, it is a fact that electrochemistry has been contributing much to the progress and development of technology in the field of atomic energy and that many interesting problems are yet to be tackled and solved.

In other words, it can be said that the electrochemistry and the atomic energy technology are in a stage where both are cooperating with each other in a sense mentioned at the beginning of this article.

In conclusion, I wonder if the electrochemical technology cannot attain a big development like that witnessed in the fields of atomic energy and electronics through more systematic and fundamental theoretical guidance are not by mere provisional improvements.

If we should consider the development of vacuum techniques and material, particularly the progress in heat-resistant materials and the production of pure metals, I believe that there are still good hopes for such a development of electrochemistry.