FLUID FUEL REACTORS

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FOREWORD

The customary approach to reactor development assumes that a reactor is primarily a mechanical engineering device—that the ultimate goal of economically competitive nuclear power will be achieved by simplifying the mechanical design and by making the fuel elements more reliable. The other, basically different, view of reactor technology holds that reactors are chemical plants—that the methods which have proved so useful in rationalizing the chemical industry, i.e., the continuous handling of materials in liquid form, should lead to ultimate economies in reactor plants. This "chemical" approach to reactors has been pursued vigorously in the United States for almost a decade; it is summarized in this volume on fluid fuel reactors.

The basic simplicity of the liquid reactor—the original idea of "a pot, pump, and pipe"—has hardly persisted throughout the years. Those who have actually built and operated high-temperature, high-powered liquid reactors have become impressed with their difficulty—the difficulty primarily of handling vast amounts of radioactivity in labile form. It seems now that liquid reactor systems, when reduced to practice, are in many ways more complicated than their solid competitors; at least their complications (being in the plumbing system) are much more obtrusive than the complications of a solid fuel reactor, which lie out of sight in the core.

Yet in spite of their difficulties, the two underlying motivations for liquid and other fluid systems remain: their fuel cycle is simpler and their neutron economy is better than for solid-fueled reactors. Thus there continues to be strong incentive to develop these systems. It is the belief of fluid fuel enthusiasts that in the very long run the simplification in fuel cycle and, more important, the better neutron economy made possible by the use of fluid fuels will outweigh the difficult handling problems and ultimately weight the balance of reactor development toward these systems.

The present volume contains a summary of the work done in the United States on fluid fuel reactors. The first part deals with the aqueous homogeneous reactor; most of this work has been done at the Oak Ridge National Laboratory, with some phases of the work (on slurries) at Westinghouse Atomic Power Division and some work on phosphate solutions at Los Alamos Scientific Laboratory. The second part deals with the fused salt system, which has been investigated primarily at the Oak Ridge Laboratory; the third part deals with the bismuth-uranium system, investigated at Brookhaven National Laboratory.

It is my hope that the results described here will be helpful to all who are interested in fluid fuel systems, and that, by disseminating this information, new ideas and new approaches will be generated to help solve the remaining problems of fluid fuel reactors.

Oak Ridge, Tenn.
June 1958

A. M. Weinberg, *Director*
Oak Ridge National Laboratory

EDITORS' NOTE

In their work on this book the editors and authors were assisted by representatives of the U. S. Atomic Energy Commission's Industrial Information Branch, Technical Information Service. Charles D. McKereghan was book project officer, and DeWitt O. Myatt guided the styling of the art. The Technical Information Service Extension at Oak Ridge put the references in final form.

The references cite a number of publications issued by the Atomic Energy Commission. These are available for inspection at the Commission's depository libraries in the United States and abroad and are sold by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

The data selected, its evaluation, and the conclusions reached in this book are wholly the work of the authors, contributors, and editors.

June 1958

James A. Lane
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Frank Maslan

CONTENTS

Part I. Aqueous Homogeneous Reactors

PART II. MOLTEN-SALT REACTORS

PART III. LIQUID-METAL FUEL REACTORS