A. Nishiyama

Nuclear Fuel Industries, Ltd.
Kumatoris, Japan

INTRODUCTION

It is my great pleasure to present you a brief summary of our activities in the field of research reactor fuel fabrication.

In 1972, Nuclear Fuels Divisions of Sumitomo and Furukawa Electric Industries merged and became a subsidiary of Sumitomo and Furukawa Industries which is now called Nuclear Fuel Industries, Ltd. We design and manufacture various kinds of nuclear fuels. As for research reactor fuel, we began our development activities in 1956. Since then we have spent over 2 million dollars for development of nuclear fuels and plant facilities including complete manufacturing and testing capabilities. Now we are the only supplier of the research reactor fuel in Japan.

Our fabrication process starts with the melting, alloying, and casting of U-Al. The uranium billets are prepared by foreign fabricators. The uranium content varies from 13 to 22 wt % according to the purchaser's specifications. In making fuel plates, the picture frame method is applied. In this case, our original procedure is sufficiently effective in avoiding dogboning.

The plates are finished by hot and cold roll milling and inspected dimensionally, metallurgically, and mechanically, and at the same time the blister test and X-ray radiographic tests are performed. Fuel elements are assembled by rolling flat or curved plates into side plate grooves and end-fit welding. Finished elements are tested dimensionally and hydraulically. Nominal losses during operation are less than 1% of the uranium metal.

Our present capacity licensed by the Japanese Government is approximately 950 fuel elements a year. About 35 employees including engineers are engaged in development and manufacturing of fuels.

Owing to the small limited demand of the research reactor fuels in Japan during the past 20 years (mostly in last 10 years), we processed only about 350 kg of highly enriched uranium and supplied approximately 1000 fuel elements to JAERI, Kyoto University, and others, and we have been suffering red-ink balance of budget every year.

I would like to discuss briefly some of our trials in development.

UO_2-Al MEAT FUEL PLATE

About 10 years ago, the vibratory compacting method was very popular among many researchers. We also spent a lot of time and money to study the economic fabrication process of fuel rods for the power reactors. By the way, we tried the feasibility study of applying the method in obtaining the high density UO_2-Al compact as the starting materials for the fuel meat. High density sintered UO_2 pellets were crushed, sieved, and uniformly blended with aluminum powders. The picture frame containing the blend was hot and cold rolled, and the finished plates were inspected. After the extensive work, we reached the conclusions that the particle size distribution of the crushed UO_2 powders must be carefully controlled in the case of high content of UO_2 and that the method is sufficient and economic to furnish the dimensionally and mechanically sound fuel plate. But, in the heating test, blisters occurred severely; therefore, the trial was stopped without any further development.

U - ALUMINIDE MEAT FUEL PLATE

According to JAERI's demand to supply some fuel plates prepared by the U - Aluminide procedure, about 5 years ago, we installed some experimental facilities and surveyed the processing of the materials. Arc melt U - Aluminide was prepared and plates containing up to 30 wt % U were furnished and inspected.

The fuel plates were quite similar and equivalent to the plate furnished after the ordinary melting and casting method, but we stopped the trials because, at the time, we had no definite objectives to continue and extend our development works.

CONCLUSION

It is very unfortunate for us that we, in the near future, will lose the chance to supply the fuels fabricated by our already established process using highly enriched uranium and to compensate our past financial deficits. At the present time, we have no firm plans whether we will develop the process of supplying the high uranium content fuels using medium enriched uranium or if we will discontinue our activities.