LETTER TO THE EDITOR

^{233}U FAST BREEDER

Dear Sir:

The breeding gain of a fast ^{232}Th-to-^{233}U breeder reactor can be directly and easily compared to that of the much more familiar ^{238}U-to-^{239}Pu breeder reactor. Since the effect of structural material, coolant, and oxide or carbide compounds used in high power reactors is to degrade the energy-dependent spectrum of the neutron flux, it is only necessary to set up a physical situation reproducing the quality of these effects in the same way for both systems. This can be done most simply by introducing several amounts of carbon, and then comparing its effect in otherwise similar reactors.

We have taken the following steps to establish a comparison[1]:

1) Produce narrow-energy-group-averaged cross sections, including anisotropic scattering effects, covering the flux spectra of interest.

2) Use these cross sections to compute the critical constants and material reactivity of a number of elements in several clean, critical experiments to establish the quantitative value of the cross sections.

3) Compute breeding gain of the ^{233}U and ^{239}Pu breeder reactors for several ratios of carbon atoms to fertile atoms.

The results of this study in terms of the net gain in fuel or daughter atoms (^{233}U or ^{239}Pu) in the reactor for each fertile or parent atom (^{232}Th or ^{238}U) lost by fission, (n,γ), $(n,2n)$, etc., are shown in Fig. 1.

The rapid decrease in breeding gain of a ^{239}Pu breeder reactor with increased flux spectrum degradation, in this case due only to ^{12}C moderation, is familiar. Not so familiar is the *increase* in the relatively low breeding gain of the ^{233}U breeder reactor toward the values actually found in fully-engineered fast breeder reactors.

We suggest that the ^{232}Th-^{233}U fast breeder reactor may merit design studies.

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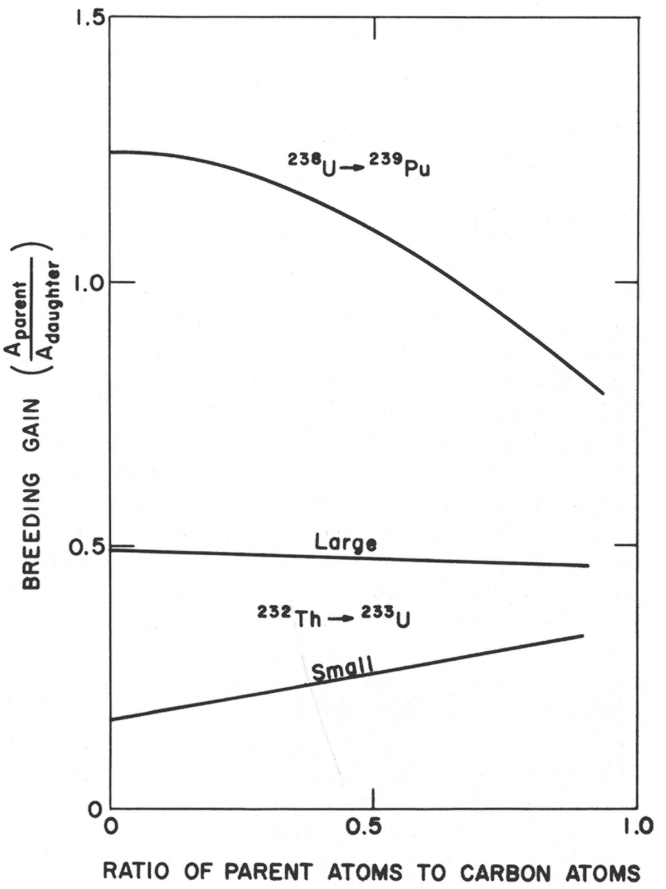

Fig. 1. Breeding gain vs (carbon/parent atom) atomic density ratio.

ACKNOWLEDGMENTS

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REFERENCES

1. C. B. MILLS, "Fast Reactor Design Calculations," LA-3724-MS, Los Alamos Scientific Laboratory (July 1967).