must fully take into account the current status of the quantitative aspects of the influence of helium on the radiation damage in the reactor and on the charged particle simulation conditions. Recent experimental results,[12] for instance, do not favor the assumption of the validity of helium pre-injection in radiation damage simulation studies. I am mentioning this important point because helium production via ^{59}Ni gains importance[7,13] only at higher fluences, i.e., after ~18 months, when the fuel assembly has absolved one-half of its residence time in the SNR-2 reactor. Helium plays an important role in stabilizing the small voids that nucleate in the initial stages of void formation. The helium that would have been produced by major constituents other than nickel and by the impurities with high cross sections in these first 18 months may well dictate the stabilization of voids, etc., in the stainless steel. There are several other factors as well that influence the final state of irradiation damage. Therefore, Goel's final recommendation on p. 104 of Ref. 7 that "... in future work to calculate the helium production rate in nickel-based stainless steel, one should take the details of the neutron flux into account" should be correctly weighed in the light of these facts.

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[12]N. H. PACKAN and K. FARRELL, *Trans. Am. Nucl. Soc.*, **33**, 290 (1979).

[13]B. GOEL, "Importance and Status of (n,α) Cross Sections for a Reliable Prediction of Radiation Damage in Stainless Steel," KFK-2473, Kernforschungszentrum Karlsruhe (1977); see also, B. GOEL, *Proc. NEANDC-NEACRP Specialists Mtg. Neutron Data of Structural Materials for Fast Reactors*, Geel, December 5-8, 1977, p. 292, Pergamon Press, Ltd., London (1977).

Response to "Futher Comments on 'Helium Production in Stainless Steel'"

In his Letter, Ganesan[1] attempts to defend his earlier publications.[2-4] Since some of the formulations published by me[5,6] in this journal are criticized, a short reply from my side is demanded. I am sorry that the discussion could not be finished by private communication. My brief comments to Ganesan's remarks are as follows:

1. Ganesan's finding is not in contradiction to my statement quoted by him.

2. Ganesan emphasizes that Birss and Ellis[7] have used "only the approximate equation" after verifying its validity. This is a sound approach in analyzing experimental data. I do not see what objection Ganesan has to this approach. His discourse on the correctness of the largest of the measured values need not be commented on. It lacks any foundation. In fact, the value (2×10^{17} atoms of helium per gram of nickel for a fluence of 10^{21} n/cm^2) used by Ganesan for his analysis[2] is even higher than the largest measured value by Weitman et al.[8] for helium production in nickel (Fig. 1).

3. Impurities are not common to all types of stainless steel. Their exact concentration and spatial distribution are often unknown. Moreover, impurities with high reaction cross section are likely to be burned out in the initial phase of reactor operation; boron, for example, is almost completely consumed at a fluence of 10^{21} n/cm^2 (Fig. 1). For contribution to the helium production due to different constituents including impurities for Type 316 stainless steel, reference is made to Table 3 of Ref. 9.

4. Here Ganesan is right. I have not quantified target accuracies for the (n,α) cross section. I welcome the work at Ganesan's laboratory on quantifying these accuracies. I only hope he uses all relevant information without any bias in his analysis. The long-term helium production may remain important for certain aspects of radiation damage.

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[1]S. GANESAN, *Nucl. Sci. Eng.*, **76**, 371 (1980).

[2]S. GANESAN, *J. Nucl. Mater.*, **62**, 329 (1976).

[3]S. GANESAN, "On the Cross Section Requirements for the Prediction of Gas Production Rates for Use in Irradiation Damage Studies in LMFBR," *Proc. National Symp. Radiation Physics*, Mysore, India, June 1976, Vol. XXVI, p. 261, University of Mysore (1976).

[4]S. GANESAN, *Nucl. Sci. Eng.*, **72**, 121 (1979).

[5]B. GOEL, *Nucl. Sci. Eng.*, **69**, 99 (1979).

[6]B. GOEL, *Nucl. Sci. Eng.*, **72**, 121 (1979).

[7]I. R. BIRSS and W. E. ELLIS, "A New Source of Helium in Cladding Materials," *Proc. Conf. Voids Formed by Irradiation of Reactor Materials*, Reading University, March 24-25, 1971, p. 339, British Nuclear Energy Society (1971).

[8]J. WEITMAN, N. DÅVERHÖG, and S. FARVOLDEN, *Trans. Am. Nucl. Soc.*, **13**, 557 (1970).

[9]B. GOEL, "Importance and Status of (n,α) Cross Sections for Reliable Prediction of Radiation Damage in Stainless Steel," *Proc. NEANDC-NEACRP Specialists Mtg. Nuclear Data of Structural Materials for Fast Reactors*, Geel, December 5-8, 1977, pp. 292 and 807, Pergamon Press Ltd., London (1977).

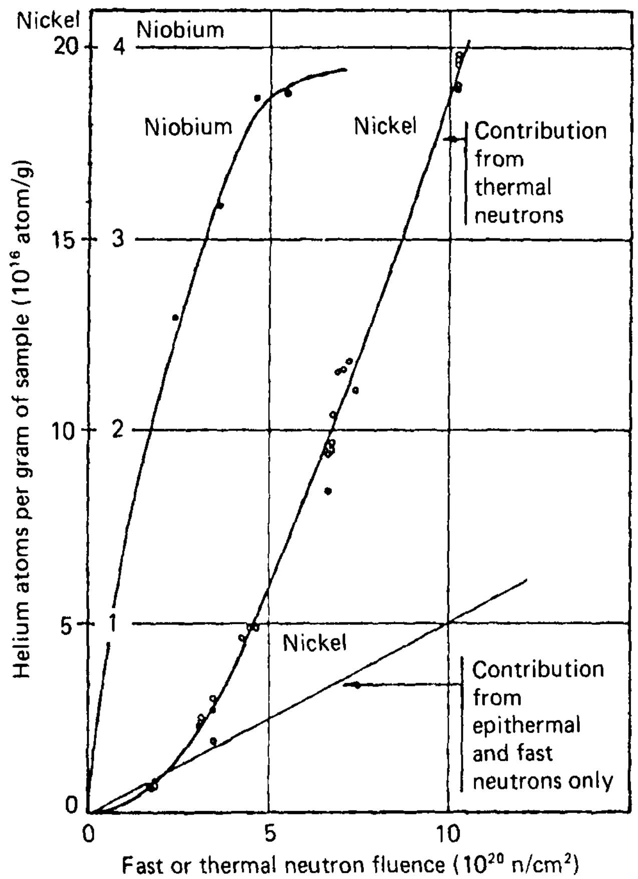

Fig. 1. Helium production as a function of neutron fluence as determined by Weitman et al. (Ref. 8). The niobium was contaminated with boron. Saturation due to boron burnup is observed in the niobium sample. (A reproduction of Fig. 1 of Ref. 7.)