visible at lower doses. The density of these smaller bubbles increase with increase of dose, meanwhile, the size of bubble increase with increasing temperature. It can be observed that nucleation and growth of helium bubbles occurred and result in the large size. As shown in Fig. 2, larger helium or hydrogen bubbles were observed in the matrix of both SIMP and T91 steel specimen irradiated at different conditions. It is clear that pre-implanted helium or hydrogen has the effect of enhancement on nucleation and growth of bubbles at higher temperature and dose. As well know that hydrogen has much more mobility than helium and may migrate easily even diffuse out of the specimen at elevated temperatures. However, there may be some interactions between He-V clusters and hydrogen which can make some stable H-containing clusters. Further works on synergistic effect of H and He on SIMP steel is being undertaken.

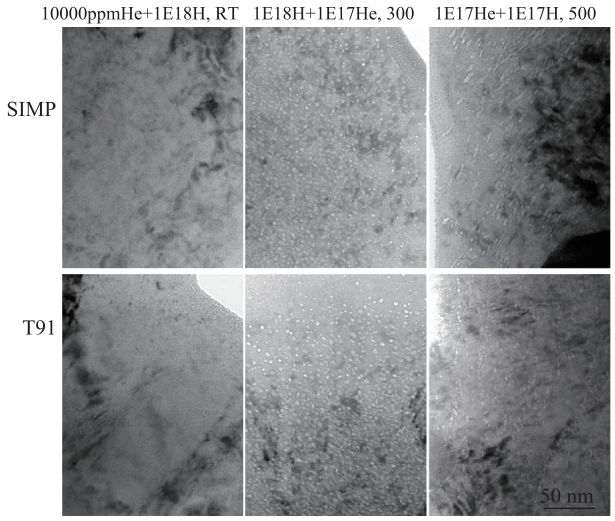

Fig. 2 Typical microstructure of bubbles induced by H/He synergistic effect in the SIMP and T91 specimens irradiated at different conditions.

4 - 7 A Facility for Studying Corrosion in High Temperature and High Pressure Water Vapor

Liu Chao and Wang Zhiguang

Nuclear fission energy has emerged over the past 40 a to become a reliable source of clean and economical energy. However, an exceptionally harsh environment, which is a big challenges to materials, presents in the core of a nuclear reactor due to the combination of high temperature, high stresses, a chemically aggressive coolant and intense radiation fluxes. Corrosion as the three major materials challenges for the current and next generation of water-cooled fission reactors need be payed more attention to[1]. Hence, a facility for studying water vapor corrosion has been developed.

The facility was developed for studying corrosion in high temperature and high pressure water vapor, and the condition of vapor such as temperature, pressure, velocity and dissolved oxygen could be controlled. The facility was comprised of a pure water system, a control system of dissolved oxygen, a heating system, a pressurization system, a constant flow pump, a heat transfer system and a data acquisition system. The main technical parameters are listed in Table 1.

Table 1 The main technical parameters.

Temperature/℃	Pressure/MPa	Velocity/(m/s)	Dissolved oxygen(min)/ppb
300∼700	1∼10	0∼10	<10

The test of the facility had been completed, and the results were shown in Fig. 1. Now the loop was operating efficiently, and the study of materials water vapor corrosion would be started.

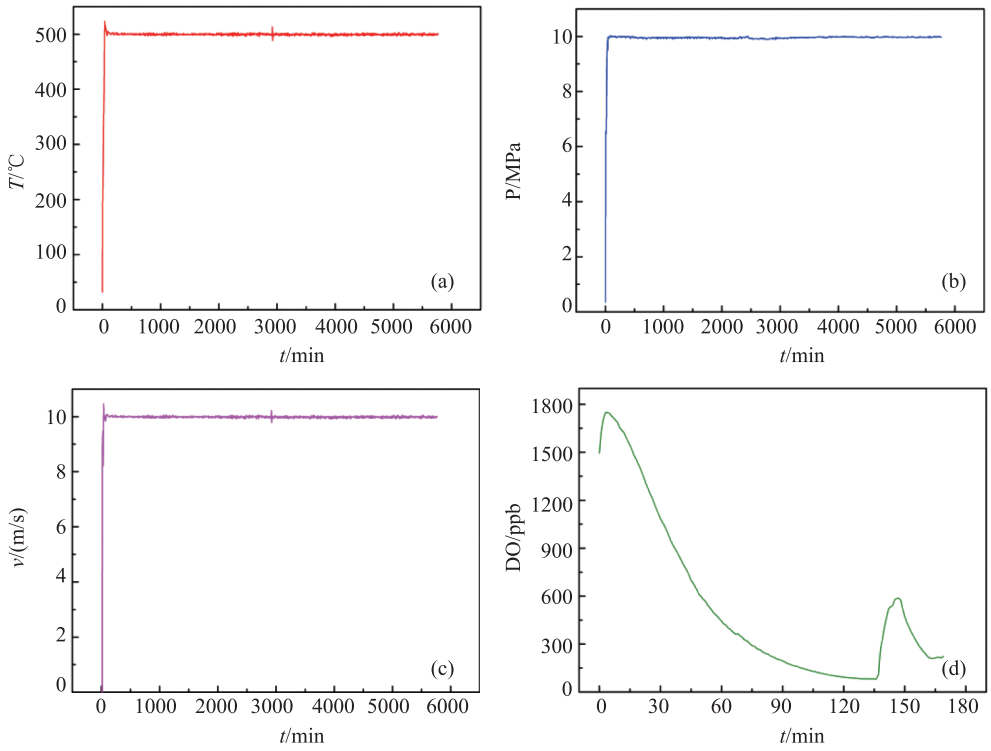

Fig. 1 (color online) The test data. (a) The temperature curve, (b) The pressure curve, (c)The velocity curve and (d) The dissolved oxygen curve.

Reference

[1] S. J. Zinkle, G. S. Was, Acta Materialia, 61(2013)735.

4 - 8 A Study of Precipitation in Martensite Steels Induced by Fe-Ion Irradiation at 300 ℃

Fang Xuesong[1,2], Shen Tielong[1], Wang Zhiguang[1], Wei Kongfang[1], Zhu Yabin[1], Sun Jianrong[1], Yao Cunfeng[1], Li Bingsheng[1], Pang Lilong[1], Cui Minghuan[1], Chang Hailong[1], Wang dong[1,2], He Wenhao[1,2], Han Yi[1,2], Zhao Sixiang[1], Tai Pengfei[1], Liu Chao[1], Ma Zhiwei[1], Gao Xing[1] and Gao Ning[1]

([1]Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou 730000, China;
[2]University of Chinese Academy of Sciences, Beijing 100049, China)

The martensite steels are accepted material used in nuclear power plant. In this study, self-ion irradiation was used to simulate the damage caused by fast neutrons in two kinds of martensite steels, SIMP and T91, under the temperature of 300 ℃. The contrast experiment on the steel samples was carried out with 352.8 MeV Fe-ions.

S parameter is a statistical conclusion about vacancy damage caused by irradiation, and it is positively related to the density of vacancy defects Figs. 1 and 2 show the change of the S parameter with the irradiation dose. Whereas Figs. 3 and 4 show the different S parameters for two kind of steels.

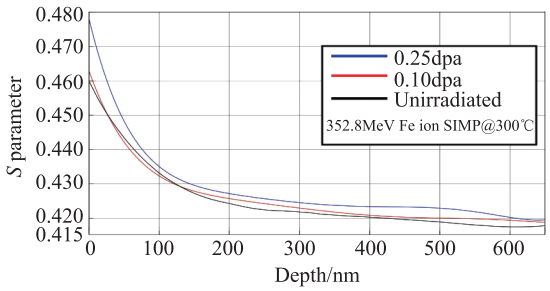

Fig. 1 (color online) S parameter varies from dpas of SIMP steels.

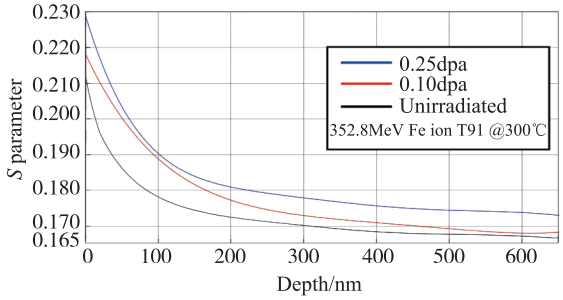

Fig. 2 (color online) S parameter varies from dpas of T91 steels.