

§12. Synthetic Evaluation of Ultra-Fine Grained, Nano-Particle Dispersed Tungsten Alloys as Plasma Facing Materials

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A LHD research project entitled "Development and synthetic evaluation of high-Z plasma facing materials" was performed for three years from 2001, by a collaborative group consisting of PSI and materials researchers from universities, NIFS, JAERI and private corporations. After that, research activities related to the project are still being continued by each member of the group, with emphasis on the synthetic evaluation of ultra-fine grained, nano-particle dispersed W-TiC alloys as plasma facing materials. The W-TiC alloys with 0.06~0.2 μ m in grain size and 99% of relative density were successfully developed in 2004-2005 using modified powder metallurgical fabrication processes and are expected to be very promising as PFM and PFC.

The following meeting was held on March 13, 2006 at NIFS in order to report the main results obtained for the ultra-fine grained W-TiC alloys and discuss the future task. Approximately 15 members got together. After the meeting, a LHD tour was also offered. The program of the meeting was as follows:

13:30-13:35 Opening H. Kurishita (Tohoku Univ.)

1. Material Development

13:35-14:05 Current status of development of ultra-fine grained, nano-particle dispersed W alloy

H. Kurishita, H. Arakawa (Tohoku Univ.), T. Takida,
M. Kato (A. L. M. T. Corp.)

2. Neutron Irradiation Effects

14:05-14:40 Neutron irradiation effects on microstructural

evolution in ultra-fine grained W-TiC alloy

K. Nakai, S. Kobayashi, Y. Amano (Ehime Univ.),
H. Kurishita (Tohoku Univ.)

3. He Irradiation Effects

14:40-15:10 Effects of He irradiation on pulsed heat-load damage in W materials

K. Tokunaga, N. Yoshida (Kyushu Univ.)

15:10-15:45 Blister formation in ultra-fine grained W-TiC alloys irradiated with low-energy He ions

H. Iwakiri, T. Baba, N. Yoshida (Kyushu Univ.)

15:45-16:15 Effects of high-energy He ion irradiation on surface damage in various W alloys including ultra-fine grained W-TiC

T. Ogawa, A. Hasegawa, K. Abe (Tohoku Univ.)

4. W Coating

16:15-16:45 Tungsten coating on low activation vanadium alloy by plasma splay process

T. Nagasaka, T. Muroga, N. Noda (NIFS), M. Kawamura,
H. Ise (Kawasaki Heavy Ind.), H. Kurishita (Tohoku Univ.)

5. Proposal of Next LHD Research Project (2006-2009)

16:45-17:15 Assessment of applicability of advanced W alloys for plasma facing materials

N. Yoshida, K. Tokunaga (Kyushu Univ.)

17:15-17:25 Summary and closing N. Noda (NIFS)

These presentations showed that the ultra-fine grained W-TiC alloys exhibit superior resistance to neutron and He irradiations, demonstrating that significant progress has been achieved towards the use of W-TiC alloys as plasma facing materials. The research outcomes will be succeeded to the next LHD research project entitled "Assessment of applicability of advanced W alloys for plasma facing materials"; the project will be conducted from 2006 to 2009 (Prof. N. Yoshida organizes the project).