Tenth International Workshop on Spallation Materials Technology

2010年10月18日星期一 - 2010年10月22日星期五 Beijing,china

摘要集

Contents

11	1
Opening address	1
Operation experiences of high power spallation targets	1
European materials R&D activities for Gen-IV and ADS	1
Developments in the design of the spallation target for MYRRHA	1
Status of the China Spallation Neutron Source(CSNS)	1
The MEGAPIE target on the way to PIE	1
SINQ target irradiation program, STIP-IC to -VI	2
Behaviors of structural materials under high energy proton and spallation neutron mixed spectrum irradiation, an overview of STIP Results	2
Materials development and testing for high dose materials applications	2
Mechanical properties of JPCA and Alloy800H irradiated up to 19 dpa at SINQ target	2
Impact properties of 9Cr tempered martensitic steels and MA957 ODS alloy irradiated in a spallation environment up to 24 dpa	2
The effect of displacement damage and helium bubble on Eurofer97 steel tensile property	2
Positron annihilation lifetime measurements of austenitic stainless steels irradiated in the SINQ target irradiation program	3
Effects of alloying elements on thermal desorption of helium in Ni alloys	3
SANS and TEM investigation of phase precipitation in HT-9 at high neutron irradiation dose levels	3
Micro-compression testing on irradiated model and structural alloys	3
Hardening effect of helium bubbles in ferritic / martensitic steels and austenitic steel SS316L	3
First principle studies of intrinsic defects in hexagonal tungsten carbide	3
Status of R&D on mitigating the effects of pressure waves for the spallation neutron source mercury target	4

at the Spallation Neutron Source	4
Two-phase flow model for energetic proton beam induced pressure waves in mercury target systems in the planned European Spallation Source	4
Post-irradiation analysis of the tantalum container of an ISOLDE LBE target	4
Pulsed E-beams to improve Corrosion Barriers for Lead Alloy Cooled Reactors: overview and dedicated Mechanical Tests	4
FeCrAlY and TiN coatings on T91 steel after irradiation with 72 MeV protons in flowing LBE	5
Influence of oxide layer strength on LME susceptibility of Si enriched steels	5
Embrittlement effects of LBE on ferritic/martensitic steels after irradiation in SINQ targets	5
Fatigue crack propagation accelerated by mercury immersion	5
Effect of cold working on the corrosion resistance of JPCA steel in flowing Pb-Bi at 450 $^\circ\!\mathrm{C}$	5
Corrosion kinetics of steel T91 in flowing oxygen-containing lead-bismuth eutectic at 450° and 550°C	6
Corrosion-erosion test of SS316L grain boundary engineering material (GBEM) in lead bismuth flowing loop	6
Nano-structure investigation of HCM12A oxide layer	6
Breakthrough technology for measuring the electrical impedance of protective steel oxide scales in LBE at temperatures up to 600°C	6
Impedance spectroscopy and microstructural characterization of the corrosion behavior of FeCrAl steel in lead-bismuth eutectic	6
Electrically rectifying properties of protective oxide layers on steels in a liquid lead-bismuth-eutectic alloy environment	6
Fabrication of a tantalum-clad tungsten target for LANSCE	7
Optimization of the thermal characteristics of an oxide high power target for radioactive ion beam production	7
A reevaluation of radiation damage cross sections	7
The expected radiation damage of CSNS target	7
Radiochemical aspects of liquid metal spallation targets	7
Overview of material R&D activities for advanced nuclear energy systems	7
R&D status on cavitation damage in JSNS of J-PARC/MLF	7
Recent developments in neutronics codes and cross section databases relevant to estimating radiation damage in materials for spallation source environments	8

induced by irradiation	8
Development of advanced materials for spallation neutron sources and radiation damage simulation code based on multi-scale model	8
Current status of toughness enhanced W-1.1%TiC development	8
The progress on R&D of CSNS target station materials	8
The study on the microwave sintering of tungsten at relatively low temperature	9
The new progress of fabrication of oxide dispersion strengthened Fine Grained Tungsten	9
Development and analysis of diffusion bonding techniques for LBE-cooled spallation targets	9
Development status of Au-In-Cd alloy as a low activation decoupler material for JSNS .	9
Development of Invar joint for hydrogen transfer line in JSNS	9
Post-irradiation analysis of refractory metal foils irradiated at high temperature for EU-RISOL 100 kW targets	9
Microwave sintering of W/Cu functional graded materials	10
Theoretical simulation of radiation effects on materials with energetic particles	10
Materials R&D needs for the ESS target station	10
Structural characterization of Lead Gold Eutectic: an x-ray thermodiffractometry study .	10
Preliminary tests on the compatibility of LGE with T91 and SS316LN steels	10
Experience with a first LGE loop and proposal for further investigations in flowing LGE	10
MHD technologies in spallation target related investigations	11

77

11

plenary session-1 / 78

Opening address

相应作者: yong.dai@psi.ch

plenary session-1 / 79

Operation experiences of high power spallation targets

相应作者: hainesjr@ornl.gov

plenary session-1 / 80

European materials R&D activities for Gen-IV and ADS

相应作者: concetta.fazio@kit.edu

plenary session-1 / 81

Developments in the design of the spallation target for MYRRHA

相应作者: paul.schuurmans@sckcen.be

Oral session-1 Progress of spallation sourse and ADS projects / 82

Status of the China Spallation Neutron Source(CSNS)

Oral session-1 Progress of spallation sourse and ADS projects / 83

The MEGAPIE target on the way to PIE

相应作者: werner.wagner@psi.ch

Oral session-1 Progress of spallation sourse and ADS projects / 84

SINQ target irradiation program, STIP-IC to -VI

相应作者: yong.dai@psi.ch

Oral session-2 Effects of radiatiion damage, helium,hydrogen and other transmutation elements in materials / 85

Behaviors of structural materials under high energy proton and spallation neutron mixed spectrum irradiation, an overview of STIP Results

相应作者: yong.dai@psi.ch

Oral session-2 Effects of radiatiion damage, helium, hydrogen and other transmutation elements in materials $/\ 86$

Materials development and testing for high dose materials applications

Oral session-2 Effects of radiatiion damage, helium,hydrogen and other transmutation elements in materials / 87

Mechanical properties of JPCA and Alloy800H irradiated up to 19 dpa at SINQ target

相应作者: saito.shigeru@jaea.go.jp

Oral session-2 Effects of radiatiion damage, helium,hydrogen and other transmutation elements in materials / 88

Impact properties of 9Cr tempered martensitic steels and MA957 ODS alloy irradiated in a spallation environment up to 24 dpa

相应作者: jean.henry@cea.fr

Oral session-2 Effects of radiatiion damage, helium,hydrogen and other transmutation elements in materials / 89

The effect of displacement damage and helium bubble on Eurofer97 steel tensile property 相应作者: tong@ciae.ac.cn

Oral Session -3 Effects of radiation damage, helium, hydrogen and other transmutation elements in materials (2) / 90

Positron annihilation lifetime measurements of austenitic stainless steels irradiated in the SINQ target irradiation program

相应作者: ksato@rri.kyoto-u.ac.jp

Oral Session -3 Effects of radiation damage, helium, hydrogen and other transmutation elements in materials (2) / 91

Effects of alloying elements on thermal desorption of helium in Ni alloys

相应作者: xu@rri.kyoto-u.ac.jp

Oral Session -3 Effects of radiation damage, helium, hydrogen and other transmutation elements in materials (2) / 92

SANS and TEM investigation of phase precipitation in HT-9 at high neutron irradiation dose levels

相应作者: jvdbosch@lanl.gov

Oral Session -3 Effects of radiation damage, helium, hydrogen and other transmutation elements in materials (2) / 93

Micro-compression testing on irradiated model and structural alloys

Oral Session -3 Effects of radiation damage, helium, hydrogen and other transmutation elements in materials (2) / 94

Hardening effect of helium bubbles in ferritic / martensitic steels and austenitic steel SS316L

相应作者: lpeng@ipp.ac.cn

Oral Session -3 Effects of radiation damage, helium, hydrogen and other transmutation elements in materials (2) / 95

First principle studies of intrinsic defects in hexagonal tungsten carbide

相应作者: csliu@issp.ac.cn

Oral Session –4 Pressure wave effects in pulsed liquid metal targets:cavitation erosion mechanisms and protection / 96

Status of R&D on mitigating the effects of pressure waves for the spallation neutron source mercury target

相应作者: riemerbw@ornl.gov

Oral Session -4 Pressure wave effects in pulsed liquid metal targets:cavitation erosion mechanisms and protection / 97

Initial observations of cavitation-induced erosion of liquid metal spallation target vessels at the Spallation Neutron Source

相应作者: mcclintockda@ornl.gov

Oral Session -4 Pressure wave effects in pulsed liquid metal targets: cavitation erosion mechanisms and protection / 98

Two-phase flow model for energetic proton beam induced pressure waves in mercury target systems in the planned European Spallation Source

相应作者: barnai@aeki.kfki.hu

Oral Session –4 Pressure wave effects in pulsed liquid metal targets:cavitation erosion mechanisms and protection / 99

Post-irradiation analysis of the tantalum container of an ISOLDE LBE target

相应作者: etam.noah@esss.se

Oral Session –5 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 100

Pulsed E-beams to improve Corrosion Barriers for Lead Alloy Cooled Reactors: overview and dedicated Mechanical Tests

相应作者: alfons.weisenburger@kit.edu

Oral Session -5 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 101

FeCrAlY and TiN coatings on T91 steel after irradiation with 72 MeV protons in flowing LBE

相应作者: yong.dai@psi.ch

Oral Session -5 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 102

Influence of oxide layer strength on LME susceptibility of Si enriched steels

相应作者: jvdbosch@lanl.gov

Oral Session -5 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 103

Embrittlement effects of LBE on ferritic/martensitic steels after irradiation in SINQ targets

相应作者: binlong@ciae.ac.cn

Oral Session -5 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 104

Fatigue crack propagation accelerated by mercury immersion

相应作者: naoe.takashi@jaea.go.jp

Oral Session -5 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 105

Effect of cold working on the corrosion resistance of JPCA steel in flowing Pb-Bi at 450°C

相应作者: rivai.abukhalid@jaea.go.jp

Oral Session –6 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 106

Corrosion kinetics of steel T91 in flowing oxygen-containing leadbismuth eutectic at 450° and 550°C

Oral Session –6 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 107

Corrosion-erosion test of SS316L grain boundary engineering material (GBEM) in lead bismuth flowing loop

Oral Session -6 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 108

Nano-structure investigation of HCM12A oxide layer

相应作者: kikuchik@mx.ibaraki.ac.jp

Oral Session –6 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 109

Breakthrough technology for measuring the electrical impedance of protective steel oxide scales in LBE at temperatures up to 600°C

相应作者: bolind@mx.ibaraki.ac.jp

Oral Session –6 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 110

Impedance spectroscopy and microstructural characterization of the corrosion behavior of FeCrAl steel in lead-bismuth eutectic

相应作者: xchen24@illinois.edu

Oral Session –6 Compatibility of liquid metals with structural materials: liquid metal corrosion and embrittlement / 111

Electrically rectifying properties of protective oxide layers on steels in a liquid lead-bismuth-eutectic alloy environment

相应作者: bolind@mx.ibaraki.ac.jp

Oral Session -7 Target and moderator engineering / 112

Fabrication of a tantalum-clad tungsten target for LANSCE

相应作者: atnelson@lanl.gov

Oral Session -7 Target and moderator engineering / 113

Optimization of the thermal characteristics of an oxide high power target for radioactive ion beam production

相应作者: etam.noah@esss.se

Oral Session -7 Target and moderator engineering / 114

A reevaluation of radiation damage cross sections

相应作者: luw2@ornl.gov

Oral Session -7 Target and moderator engineering / 115

The expected radiation damage of CSNS target

相应作者: wenyin@aphy.iphy.ac.cn

Oral Session -7 Target and moderator engineering / 116

Radiochemical aspects of liquid metal spallation targets

相应作者: joerg.neuhausen@psi.ch

Plenary Session - 2 / 117

Overview of material R&D activities for advanced nuclear energy systems

相应作者: ycwu@ipp.ac.cn

Plenary Session - 2 / 118

R&D status on cavitation damage in JSNS of J-PARC/MLF

Plenary Session - 2 / 119

Recent developments in neutronics codes and cross section databases relevant to estimating radiation damage in materials for spallation source environments

Discussion Session -1 Advanced experimental techniques for assessing microstructural and mechanical changes induced by irradiation / 120

Advanced experimental techniques for assessing microstructural and mechanical changes induced by irradiation

Oral Session -8 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 121

Development of advanced materials for spallation neutron sources and radiation damage simulation code based on multi-scale model

相应作者: masayoshi.kawai@kek.jp

Oral Session -8 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 122

Current status of toughness enhanced W-1.1%TiC development

相应作者: kurishi@imr.tohoku.ac.jp

Oral Session -8 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 123

The progress on R&D of CSNS target station materials

Oral Session -8 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 124

The study on the microwave sintering of tungsten at relatively low temperature

Oral Session -8 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 125

The new progress of fabrication of oxide dispersion strengthened Fine Grained Tungsten

Oral Session -9 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 126

Development and analysis of diffusion bonding techniques for LBE-cooled spallation targets

相应作者: atnelson@lanl.gov

Oral Session –9 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 127

Development status of Au-In-Cd alloy as a low activation decoupler material for JSNS

相应作者: ohi.motoki@jaea.go.jp

Oral Session -9 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 128

Development of Invar joint for hydrogen transfer line in JSNS

Oral Session -9 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 129

Post-irradiation analysis of refractory metal foils irradiated at high temperature for EURISOL 100 kW targets

相应作者: etam.noah@esss.se

Oral Session -9 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 130

Microwave sintering of W/Cu functional graded materials

相应作者: qffang@issp.ac.cn

Oral Session -9 Innovative materials technology R&D for applications to extreme irradiation environments in respect to: proton / neutron fluxes, temperature, stress, corrosive coolant, etc. / 131

Theoretical simulation of radiation effects on materials with energetic particles

相应作者: ygli@theory.issp.ac.cn

Oral Session -10 ESS Target and Structural Materials Issues / 132

Materials R&D needs for the ESS target station

相应作者: etam.noah@esss.se

Oral Session -10 ESS Target and Structural Materials Issues / 133

Structural characterization of Lead Gold Eutectic: an x-ray thermodiffractometry study

相应作者: marisa.medarde@psi.ch

Oral Session –10 ESS Target and Structural Materials Issues / 134

Preliminary tests on the compatibility of LGE with T91 and SS316LN steels

相应作者: yong.dai@psi.ch

Oral Session -10 ESS Target and Structural Materials Issues / 135

Experience with a first LGE loop and proposal for further investigations in flowing LGE

相应作者: knud.thomsen@psi.ch

Oral Session -10 ESS Target and Structural Materials Issues / 136

MHD technologies in spallation target related investigations

相应作者: erik@sal.lv