CNIC-01270

中国核科技报告

CHINA NUCLEAR SCIENCE AND TECHNOLOGY REPORT

文　　摘

ABSTRACTS

1997

中国核情报中心
原子能出版社

China Nuclear Information Centre
Atomic Energy Press

CNIC-01270

中国核科技报告文摘

（1997 年）

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中国核情报中心
原子能出版社
北京 · 1998. 5

图书在版编目(CIP)数据

中国核科技报告文摘(1997) =CHINA NUCLEAR SCIENCE & TECHNOLOGY REPORT (1997)/中国核情报中心. 北京:原子能出版社,1998.6

ISBN 7-5022-1848-3

Ⅰ.中… Ⅱ.丁… Ⅲ.核技术-研究报告-中国-文摘 Ⅳ.TL-24

中国版本图书馆 CIP 数据核字 (98) 第 15086 号

中国核科技报告文摘(1998)

原子能出版社出版发行

责任编辑:武 洁

社址:北京市海淀区阜成路 43 号 邮政编码:100037

中国核科技报告编辑部排版

核科学技术情报研究所印刷

开本 787×1092 1/16 · 印张 6 字数 120 千字

1997 年 9 月北京第一版 · 1997 年 9 月北京第一次印刷

定价:15.00 元

摘　要

文摘包括1997年度出版的《中国核科技报告》（报告号CNIC-01131～CNIC-01230）各篇的题录和摘要，款目按国际核情报系统（INIS）的类目进行编排。六大类目依次为：物理科学；化学、材料与地球科学；生命科学；同位素、同位素应用与辐射应用；工程与技术；核能其他问题。每篇款目的左上角的编号是报告号，右上角的编号是款目顺序号。最后附有1997年度出版的报告的号码索引。

关键词　文摘　CNIC　核科技报告　报告号索引

ABSTRACT

The bibliographies and abstracts of China Nuclear Science and Technology Reports published in 1997 (Report Numbers CNIC-01131～CNIC-01230) are presented. The items are arranged according to INIS subject categories, which mainly are physical sciences, chemistry, materials, earth sciences, life sciences, isotopes, isotope and radiation applications, engineering and technology, and other aspects of nuclear energy. The numbers on the left corners of the entries are report numbers, and on the right corners the serial numbers. A report number index is annexed.

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Plasma Physics and Thermonuclear Reactions

CNIC-01177; SIP-0099 970001

氢中性束在等离子体中透射情况的分析与计算/王惠三，姜韶风，卢大伦（核工业西南物理研究院，成都）

阐述了中性束加热等离子体的物理过程，并利用基于不同物理模型下的两种计算方法对中性束在等离子体中的透射衰减情况进行了计算、分析和比较，给出了束在等离子体中的衰减与束能量、等离子体参数及杂质情况的关系及在 HL-1M 等离子体典型参数下的计算结果。在考虑了中性束与等离子体（含杂质）相互作用多级过程的数值计算中，其物理模型考虑了激发、碰撞和辐射去激发、被激发原子的 Lorentz 场电离以及电离、电荷交换等多种过程。在利用简化物理模型的分析计算中，仅考虑了中性束与等离子体和杂质粒子的电离和电荷交换过程。两种计算结果都表明中性束在等离子体中的穿透系数均随中性束能量 E_0 的提高而增大，随等离子体密度 n_e 的增高而减少，并表明在 $n_e \leqslant 10^{14}\ cm^{-3}$，$20 \leqslant E_0$ (keV/u) $\leqslant 100$ 域内，利用简化物理模型的分析计算与考虑多级过程的数值计算相比，两者的等离子体对中性束的有效阻止截面相差$\leqslant 20\%$。

THE ANALYSIS AND CALCULATION OF H^0 NEUTRAL BEAM ATTENUATION DUE TO PENETRATION INTO TOKAMAK PLASMA/ WANG Huisan, JIANG Shaofeng, LU Dalun (Southwestern Institute of Physical, Chengdu) (*In Chinese*)

The physical processes of the neutral beam heated plasma is described. The penetration attenuation of the neutral beam in the plasma has been calculated, analysed and compared by means of two kinds of calculation methods based on different physical models. The dependence of neutral beam decay in the plasma on the beam energy, plasma parameters and impurity has been investigated. The calculation results of the beam attenuation for HL-1M typical plasma parameters also have been given. In numerical calculation taking multistep collision processes of the interaction between the beam and the

plasma into account, its physical model includes excitation, collisional and radiative de-excitation, ionization, charge exchange and Lorentz field ionization of excited atoms. In the analytical calculation using the simple physics model, the ionization of the neutral beam and the charge exchange between the beam and the particles of the plasma and impurity are only taken into account. Both calculation results show that the penetration coefficient of the neutral beam entering the plasma increases with the neutral beam energy E_0, and decreases with the plasma density n_e, and show that comparing the analytical calculation using simple physics model with the numerical calculation taking multistep processes into account in the range of $n_e \leqslant 10^{14}\,cm^{-3}$ and $20 \leqslant E_0(keV/u) \leqslant 100$, the effective stopping cross-section of the former is $\leqslant 20\%$ less than that of the latter.

CNIC-01168; SIP-0098 970002

HL-1M 欧姆加热等离子体实验的初步分析/秦运文，王恩耀，严建成，谈满秋，袁宝山，董贾福，HL-1M 实验组（核工业西南物理研究院，成都）

介绍了中国环流器新一号（HL-1M）托卡马克装置及其诊断、数据采集与处理系统，并对有关气体再循环、等离子体平衡与稳定性的实验结果进行了初步分析和讨论。该装置现已获得 $I_p=322$ kA，$q<2.5$，$\bar{n}_e=6\times10^{13}\,cm^{-3}$，$T_e(0)>1$ keV，$T_i(0)>0.5$ keV 和 $\tau_E\approx10$ ms 的平衡稳定等离子体。

PRELIMINARY RESULTS OF OHMICALLY HEATED PLASMA EXPERIMENTS ON THE HL-1M TOKAMAK/QIN Yunwen, WANG Enyao, YAN Jiancheng, TAN Manqiu, YUAN Baoshan, DONG Jiafu and HL-1M Team (Southwestern Institute of Physics, Chengdu)

The HL-1M tokamak ($R=102$ cm, $a=26$ cm, $B_T=3$ T, $I_p=350$ kA) has operated since October 24, 1994 with ohmically heated plasmas. An equilibrium and stable plasma was obtained with $I_p=322$ kA, $q<2.5$, $\bar{n}_e=6\times10^{13}\,cm^{-3}$, $T_e(0)>1$ keV, $T_i(0)>0.5$ keV and $\tau_E\approx10$ ms. The HL-1M device, plasma diagnostics and data acquisition and processing system are briefly described, and the experimental data on gas recycling, plasma equilibrium and MHD stability are preliminarily analyzed.

CNIC-01163; SIP-0097 970003

强功率加热下托卡马克的局域输运模型及定标关系/石秉仁（核工业西南物理研究院，成都）

提出了一种简单的，唯象地确定的热传导模型以用于强功率加热下的 L-模和 H-模的

约束分析。如假定中心热导率与中心等离子体温度成正比，则所得能量约束时间将自动与外加热功率的平方根的倒数成正比。讨论了锯齿效应、边缘 H-模效应及中心热垒效应。用该模型来讨论氘、氚燃烧过程中的等离子体约束性能，其结果将比通常应用的零维等值线分析法（POPCon）得到的大为改进。

TOKAMAK LOCAL TRANSPORT MODEL AND SCALING RELATIONS UNDER HIGH POWER HEATINGS/SHI Bingren (Southwestern Institute of Physics, Chengdu)

A simple, phenomenologically determined thermal conductivity model is suggested which will suit for L-mode and H-mode confinement analysis for high auxiliary heatings. By assuming that the central conductivity is proportional to the central temperature, the resultant energy confinement time will be automatically proportional to $P_{tot}^{-1/2}$. The sawtooth effect, edge H-mode and central thermal barrier situations are discussed. This model can be extended to discuss the D and T burning process to greatly improve the usually used zero-dimensional POPCon analysis.

CNIC-01131; SIP-0096 970004

HL-1 装置在 OH 和 LHCD 的反常多卜勒不稳定性/曹建勇，徐德明，丁玄同，王恩耀（核工业西南物理研究院，成都）

在 HL-1 托卡马克装置上，采用不同频率的微波外差接收机测量欧姆放电下和低混杂波驱动下的非热辐射。文章描述了在欧姆放电下，由磁化等离子体波辐射，相对论电子的契伦柯夫辐射，以及非麦氏分布电子的回旋辐射（ECE）所表现出的反常多卜勒不稳定性特征，即主要表现为磁化等离子体波扰动，以及契伦柯夫辐射迅速下降所对应的 ECE 增加。这种不稳定性是由于电子分布各向异性所引起的，在低混杂波驱动下不稳定性受到抑制，同时等离子体粒子约束得到改善。讨论了反常多卜勒不稳定性被低混杂波驱动所抑制的可能机制以及与等离子体粒子约束改善之间的关系。

THE ANOMALOUS DOPPLER INSTABILITIES DURING OH DISCHARGES AND LHCD ON HL-1/CAO Jianyong, XU Deming, DING Xuantong, WANG Enyao (Southwestern Institute of Physics, Chengdu)

Microwave heterodyne receivers were used to measure the nonthermal emission during ohmic (OH) discharges and lower hybrid current driven (LHCD) on the HL-1 tokamak. The nonthermal emission caused by magnetic plasma wave, electron cyclotron emission (ECE) and Cherenkov emission of the relativistic electrons has been described in detail. The fluctuation of the magnetic plasma wave emission and the abrupt increasing of ECE are related to the anomalous Doppler instabilities (ADI) driven by tail anisotropy of the electron distribution function. During LHCD, ADI is suppressed obviously and

the particle confinement is improved. The suppression mechanism of ADI, and the relations between the suppression of ADI and the improvement of the particle confinement are discussed.

CNIC-01204; SIP-0102 970005

核工业西南物理研究院的等离子体源离子注入技术研究/尚振魁，耿漫，童洪辉（核工业西南物理研究院，成都）

介绍了等离子体源离子注入装置 PSII-EX 原型机和 PSII-IM 工业样机，并对其功能、主要技术指标及特点作了简述。等离子体源离子注入处理后，一些材料表面机械性能（如显微硬度、耐磨性、摩擦因数及生物相容性等）的改善情况、改性层的微观分析及计算机模拟结果、工艺开发及初步的等离子体源离子注入增强沉积实验也作了介绍。最后提出了拟开展的有关 PSII 工作。

PLASMA SOURCE ION IMPLANTATION RESEARCH AT SOUTHWESTERN INSTITUTE OF PHYSICS/SHANG Zhenkui GENG Man TONG Honghui (Southwestern Institute of Physics, Chengdu)

The PSII-EX device and PSII-IM device for research and development of plasma source ion implantation (PSII) technology are described briefly. The functions, main technical specifications and properties of the devices are also discussed. After ion implantation by PSII, the improvements of the surface-mechanical properties (such as microhardness, wear-resistance, friction factor, biological compatibility, etc) for some materials, microanalysis and numerical simulation of modified layers of materials, the technical developments for the practical workpiece treatments and the preliminary experiments for plasma source ion implantation-enhanced deposition are introduced too. The future work about PSII have been proposed.

CNIC-01167; ASIPP-0049 970006

低环径比托卡马克堆中等离子体特性及 α 粒子输运/徐 强，王少杰（中国科学院等离子体物理研究所，合肥）

低环径比托卡马克装置的实验和理论结果已证实它有利于改善 MHD 稳定性。基于目前等离子体物理，向减小环径比方向外推，初步讨论了低环径比托卡马克堆的物理特征。在自洽的低环径比托卡马克堆参数下，计算了 α 粒子约束和损失以及不同环径比对 α 粒子约束和损失的影响。此结果对紧凑托卡马克堆的可行性研究提供参考。

PLASMA FEATURES AND ALPHA PARTICLE TRANSPORT IN LOW-ASPECT RATIO TOKAMAK REACTOR/XU Qiang, WANG Shaojie (Institute of Plasma Physics, Academia, Sinica)

The results of the experiment and theory from low-aspect ratio tokamak

devices have proved that the MHD stability will be improved. Based on present plasma physics and extrapolation to reduced aspect ratio, the feature of physics of low-aspect ratio tokamak reactor is discussed primarily. Alpha particle confinement and loss in the self-justified low-aspect ratio tokamak reactor parameters and the effect of alpha particle confinement and loss for different aspect ratio are calculated. The results provide a reference for the feasible research of compact tokamak reactor.

CNIC-01187; SIP-0101 970007

脉冲分子束注入 HL-1M 装置等离子体行为研究/姚良骅，唐年益，崔成和，崔正英，徐德明，丁玄同，邓中朝（西南物理研究院，成都）

介于已有的喷气（Gas puffing）和弹丸注入（Ice pellet injection）之间，提出了一种新的托卡马克加料手段——脉冲超声分子束注入。在较高的粒子注入通量 5×10^{19}/脉冲时，氢分子的速度仍可达到 500 m/s。一系列氢分子束脉冲注入初始密度为 $\bar{n}_e=0.4\times10^{19}$ m^{-3} HL-1M 真空室氢等离子体，经过 160 ms，密度上升至 $\bar{n}_e=5.4\times10^{19}$ m^{-3}。根据脉冲分子束注入初期氦光谱（He I 587·6 nm）强度的径向分布，1/3 峰高位于 $r=12$ cm 附近。注入后粒子约束时间增加 5 倍。由于气体粒子注入深化，电子密度峰化因子 $Q_n=\frac{n_e(0)}{\langle n_e\rangle}=1.52$。能量约束时间 $\tau_E=26$ ms 的状态持续达 350 ms。与常规喷气加料相比，在相同工作气体和相似的等离子体参数条件下，分子束注入加料等离子体能量约束时间高 30%以上。其约束改善和密度峰化状态可以与 ASDEX 装置低速弹丸注入加料相比拟。由于加料粒子注入的深入引起密度峰化是约束改善的主要因素。

THE PLASMA BEHAVIOR WITH MOLECULAR BEAM INJECTION IN THE HL-1M TOKAMAK/YAO Lianghua, TANG Nianyi, CUI Chenghe, CUI Zhengying, XU Deming, DING Xuantong, DENG Zhongchao (Southwestern Institute of Physics, Chengdu)

A new method of gas fueling has been introduced to HL-1M. The method of a pulsed supersonic molecular beam injetion is formed by a conical or cylindrical Laval nozzle. The well collimated hydrogen beam velocity is about 500 m/s. About 5×10^{19} molecules pass through the nozzle to get into the vacuum chamber within a single pulse. A series of helium pulses were injected into HL-1M low density ($\bar{n}_e=4\times10^{18}$ m^{-3}) hydrogen plasma up to 12 cm depth, the ramp-up rate of electron density $d\bar{n}_e/dt$ was as high as 3.1×10^{20} $m^{-3}\cdot s^{-1}$ at steady state and the resulted plasma density reaches $\bar{n}_e=5.4\times10^{19}$ m^{-3}. The increasing of profile peaking factor of electron density ($Q_n=n_e(0)/\langle n_e\rangle$) is after about 100 ms He molecular beam injection (MBI) and the maximum Q_n value is larger than 1.52. The global particle confinement times

increased by 6 times in comparison with that before injection. The energy confinement time τ_E measured by diamagnetic was 26 ms, which is over 30% longer than that of gas puffing (GP) results under the same operation condition. The τ_E improvement and Q_n increase of MBI seem to compare to those of slow (ASDEX) pellet injection, respectively. It is shown that the peaked density profile induced by deepened particle injection is an essential factor responsible for the confinement improvement apart from the isotope effect of helium particles, because the density peaking factor Q_n normally is less than 1.4 for GP plasma on HL-1M.

CNIC-01186; SIP-0100 970008

托卡马克位形求解的网格精细化/牟宗泽，简广德，张锦华，彭点云（西南物理研究院，成都）

先进的托卡马克位形对于实现磁约束受控聚变是至关重要的。但对某些情况，精确计算位形是十分困难的。如当物理量在局部区域内有很大的变化，或在区域内解的数值大小有大的数量级上的改变，为保证数值求解平衡方程的收敛性，有两个困难随之产生了：(1) 所需的计算机内存极大地增加，以致有的物理模式的计算受到计算机内存的限制。(2) 求解代数方程阶次的迅速增长，可能使舍入误差的积累造成对真解的扭曲。利用两种不同的网格精细化方法与差分方程解的外推过程相结合，能更精确地求解等离子体平衡方程。理论分析和数值实验都说明方法是有效的。

MESH REFINEMENT FOR SOLVING TOKAMAK CONFIGURATIONS/ MOU Zongze, JIAN Guangde, ZHANG Jinhua, PENG Dianyun (Southwestern Institute of Physics, Chengdu) (*In Chinese*)

Advanced tokamak configurations are very important for achieving magnetic confinement control of nuclear fusion. However, in some case accurate computation of the configuration poses a formidable challenge. For example there is a change of physical variable with gradient in local domain, or with great difference of the order of its magnitude in the domain. In order to guarantee numerical convergence for solving plasma equilibrium equation, two trouble issues arise as the following: (1) Required computer memories increase so rapid as to restrict computation to some physical mode. (2) The order of matrix for solving algebraic equations increases so greatly that the accumulated round off errors can swamp the true solutions. We adopt two kinds of different mesh refinement process combining extrapolation of difference solution for more accurately solving tokamak plasma equilibrium equation. The numerical test and theoretical analysis show that the methods are robust.

A30.00 中子物理学与核物理学

NEUTRON AND NUCLEAR PHYSICS

A34.00 核性质与反应

Nuclear Properties and Reactions

CNIC-01140; CNDC-0019 970009

核数据进展通讯 No. 16 (1996)

COMMUNICATION OF NUCLEAR DATA PROGRESS No. 16 (1996) / (China Nuclear Data Center, Beijing)

This is the 16th issue of *Communication of Nuclear Data Progress* (CNDP), in which the achievements in nuclear data field for the last year in P. R. China and a paper from India are carried. It includes the measurements of neutron activation cross section for ^{193}Ir (n, 2n) ^{192m2}Ir reaction at 14.7 MeV and fragment angular distributions in the fission of ^{197}Au, ^{207}Pb and ^{209}Bi induced by alpha particles up to 70 MeV; discrete level effect on spectrum calculations of secondary particles, calculations of n + ^{235}U (E_n = 5 MeV) scattering angle distribution by ECIS95 and various cross sections for n+^{169}Tm and ^{103}Rh reactions up to 100 MeV and 25 MeV respectively, and p + ^{52}Cr reactions up to 30 MeV; evaluations of H total neutron cross section from 20 MeV to 2 GeV and ^{169}Tm (n, xn) ^{168,167,166,165}Tm reactions from threshold to 100 MeV, evaluation and calculation of production cross sections for ^{11}C, ^{13}N and ^{15}O medical radioisotopes from ^{11}B, ^{13}C, ^{15}N (p, n) and ^{16}O (p, x) ^{13}N reactions up to 80 MeV; an approach of a systematic description of gamma-ray spectra from (n, xγ) reactions induced by fast neutron; data files of optical model parameter and level density sub-libraries.

CNIC-01170; CNDC-0020 970010

核数据进展通讯 No. 17 (1997)

COMMUNICATION OF NUCLEAR DATA PROGRESS No. 17 (1997) /LIU Tingjin, ZHUANG Youxiang, et al. (China Nuclear Data Center)

This is the 17th issue of *Communication of Nuclear Data Progress* (CNDP), in which the nuclear data achievements and progress in China during the last year are carried, including measurements of angular distributions at 6.0 and 7.0 Mev for ^{58}Ni(n,α)^{55}Fe and ^{54}Fe(n,α) ^{51}Cr reactions, and activation

cross sections for $^{182,184}W$ (n, p), $^{182,186}W$ (n, 2n), ^{182}W (n, n'α), ^{186}W (n, α) reactions around 14 MeV and ^{180}Hf (n, γ) reaction at 0.52～1.60 MeV; SUNF Code for fast neutron data calculation, adjustment of the parameters in the calculations of the γ-production data, calculations of d+$^{6,7}Li$, ^{7}Be, ^{51}V, ^{52}Cr, $^{56,57}Fe$, p+$^{56,57}Fe$ and n+^{169}Tm reactions; evaluations of $^{46,47}Ti$, ^{59}Co, ^{60}Ni (n, p), $^{58,60,61,62,64,Nat}Ni$, ^{169}Tm, ^{181}Ta (n, 2n), ^{169}Tm (n, 3n), (n, γ), (n, x) reactions; a new method to correct ^{238}U fission rate measured using uranium foils, the integral test of the reactor dosimetry data; systematics calculation for cross section of (p, n) reaction on 16 targets up to 100 MeV; energy balance for natural elements, progress on Chinese Evaluated Nuclear Parameter Library; activities and cooperations on nuclear data in China in 1996.

CNIC-01230 970011

CNDC-0021 核数据进展通讯 No. 18 (1997)

COMMUNICATION OF NUCLEAR DATA PROGRESS No. 18 (1997) /LIU Tingjin, ZHUANG Youxiang, et al. (China Nuclear Data Center)

This is the 18th issue of *Communication of Nuclear Data Progress* (CNDP), in which the achievements of nuclear data field for the last year in P. R. China are carried. It includes the measurements of angular distributions and energy spectra for $^{58}Ni(n,p)^{58}Co$ reaction at 4.1 MeV, and activation cross sections for $^{159}Tb(n,\gamma)^{160}Tb$ and $^{169}Tb(n,\gamma)^{170}Tb$ reactions at 0.4～4.0 MeV and 0.16～3.0 MeV, respectively; n+^{239}Pu coupled channel optical model and DWBA calculations, analysis of d+^{16}O and p+^{18}F reactions, calculations of (n, p) reaction cross sections for Zinc isotopes and n+^{176}Hf; evaluations of n+^{235}U fission product data and study of the dependence of fission yield data on neutron energy, decay data evaluation for radionuclide ^{7}Be, evaluations of ^{55}Mn, ^{54}Fe, ^{59}Co, ^{62}Ni, and ^{63}Cu (n, α) reaction cross sections, evaluations and calculations of $^{158,159}Tb$ (n, 2n), (n, 3n), (n, γ) and (n, x) reaction cross sections below 20 MeV; the systematics research on (p, n) and (p, 2n) reaction excitation functions; and the sub-library of atomic masses and characteristic constants of nuclear ground states (ECNPL-MCC 2).

CNIC-01160; SUINST-0013 970012

^{58}Ni 全套中子核数据的评价/马功桂，王世明（四川联合大学原子核科学技术研究所，成都）

评价了^{58}Ni 在 10^{-5} eV 到 20 MeV 能区的全套中子数据。数据包括全截面、弹性、去弹、总非弹，九条分立能级和连续态的非弹及 (n, 2n), (n, 3n), (n, n′α) + (n, αn′), (n, n′p) + (n, pn′), (n, p), (n, d), (n, t), (n, α) 和 (n, γ) 反应截面，还包括次级中子角分布、双微分截面 (DDCS)，γ 产生数据和共振参数。评价依据直到 1995 年测量的实验数据和用 UNF 程序的理论计算。评价数据以 ENDF/B-6 格式入中国评价核数据库第三版 (CENDL-3)。

THE EVALUATION OF COMPLETE NEUTRON NUCLEAR DATA FOR ^{58}Ni/MA Gonggui, WANG Shiming/ (Institute of Nuclear Science and Technology, Sichuan University, Chengdu)

The complete neutron data were evaluated for ^{58}Ni in the energy range 10^{-5} eV to 20 MeV. The data included total, elastic, non-elastic, total inelastic, inelastic cross sections to 9 discrete levels, inelastic continuum, (n, 2n), (n, 3n), (n, n′α) + (n, αn′), (n, n′p) + (n, pn′), (n, p), (n, d), (n, t), (n, α) and capture cross sections. The angular distribution of secondary neutron, the double differential cross sections (DDCS), the gamma-ray production data and the resonance parameters are also included. The evaluation is based on both experimental data measured up to 1995 and calculated data with program UNF. The evaluated data will be adopted into CENDL-3 in ENDF/B-6 format.

CNIC-01149; IAE-0163 970013

***E_p*≤200 MeV 质子与 Si 反应截面的理论计算**/申庆彪，韩银录，田，野（中国原子能科学研究院，北京），蔡崇海（南开大学，天津）

对 3～200 MeV 能区质子与 Si 的各种反应截面进行了计算，在符合多种可得到的实验数据的情况下，预言了 6 种粒子的发射截面和多种剩余核的产生截面，在低能区理论与实验符合较好，在高能区理论和实验相比可能会有 1～2 倍的偏差，尚待改进。这些数据对于研究半导体器件材料 Si 在宇宙线质子照射下所发生的性能变化以及研究中能加速器的辐射屏蔽等是很有价值的。

THEORETICAL CALCULATIONS OF CROSS SECTIONS FOR ELEMENT Si INDUCED BY PROTONS WITH ENERGY *E_p*≤200 MeV/SHEN Qingbiao, HAN Yinlu, TIAN Ye (China Institute of Atomic Energy, Beijing) CAI Chonghai (Nankai University, Tianjin) (*In Chinese*)

Various cross sections of element Si induced by protons in the energy region 3～200 MeV are calculated based on nuclear reaction models. The calculated emission cross sections of emitted particles p, α, n, d, ^{3}He, t and production cross sections of many residual nuclei are reasonable and in

agreement with the available experimental data basically. These nuclear data are very valuable for studying the changing of performance on the material Si of semiconductor devices under irradiation of the cosmic ray protons and the reaction cross sections of the material Si for radiation shielding of intermediate energy accelerators.

B00.00 化学、材料与地球科学

CHEMISTRY, MATERIALS AND EARTH SCIENCES

B10.00 化学

CHEMISTRY

B11.00 化学分析与同位素分析

Chemical and Isotopic Analysis

CNIC-01136; IAE-0161 970014

真空蒸馏-石墨炉原子吸收光谱法测定钠中锂/谢 淳，孙世平，贾云腾，文希孟（中国原子能科学研究院，北京）

快堆用钠冷却剂中锂的含量对堆的核性能有较大影响，为了检测核级钠中锂的含量，建立了真空蒸馏-石墨炉原子吸收光谱法测定金属钠中微量锂的方法。在氩气氛下取 4.0 g 左右钠于钽坩埚中，在 360℃及 0.01 Pa 真空度下蒸馏除钠，残渣用硝酸（1∶2）溶解后，在 671.0 nm 波长处，用石墨炉原子吸收光谱法测定锂。实验中对蒸馏条件、石墨炉原子吸收测试条件及来自于基体钠、酸及共存元素的干扰等进行了一系列研究，用氯化锂和硝酸锂做加钠回收实验，回收率分别为 96.8%及 97.4%，相对标准偏差小于 5%。该方法满足了核级钠中杂质锂（$<1\times10^{-5}$）的质量监测要求，达到了国际上同类分析方法的水平，已用于国产工业钠原料和净化后的高纯钠中锂含量的分析。

DETERMINATION OF LITHIUM IN SODIUM BY VACUUM DISTILLATION-GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROSCOPY/XIE Chun, SUN Shiping, JIA Yunteng, WEN Ximeng (China Institute of Atomic Energy, Beijing) (*In Chinese*)

When sodium is used as a coolant in China Experimental Fast Reactor, the lithium content in sodium has an effect on the nuclear property of reactor. A method has been developed to determine the trace lithium in scdium metal at the level of less than ten parts per million. About 0.4 g sodium is placed into

a high-purity tantalum crucible, then it is placed in a stainless-steel still to distill at 360℃ under vacuum (0.01 Pa). After the sodium has been removed, the residue is dissolved by nitric acid (1 : 2) and analyzed with Graphite Furnace Atomic Absorption Spectroscopy at 671.0 nm wavelength. The distillation conditions, working conditions of the instrument and interferences from matrix sodium, acid and concomitant elements have been studied. Standard addition experiments are carried out with lithium chloride and lithium nitrate. The percentage recoveries are 96.8% and 97.4% respectively. The relative standard deviation is less than ±5%. The method has been used to determine lithium content in high pure sodium and industrial grade sodium.

CNIC-01161; LIHMPH-0011 970015

用γ谱分析法研究不同经典样品处理方法对分析结果的影响/苏 琼(卫生部工业卫生实验所环境放射卫生监测室,北京)

按文献推荐的条件,采用炭化-灰化和粉碎研磨两种样品处理方法对生物样品茶叶及面粉进行了处理。用γ谱测量技术对其中的放射性核素进行了分析。结果表明:这两种制样方法至少导致了茶叶样品的测试结果间有显著性差异,而炭化-灰化样品处理方法使得样品中一些核素产生严重丢失;虽然,炭化-灰化制样技术比(准)不破坏制样技术可以极大地改善测量灵敏度,但是,其适用样品种类及核素仍有某些局限性,因此,应用必须谨慎。结果还表明,开展不同经典样品处理方法对分析结果影响的研究在当前仍是十分有意义的。文中还对不同制样方法对茶叶和面粉产生的迥然不同影响的可能原因作了讨论。

USING γ SPECTROMETRY TO STUDY THE INFLUENCE ON DETERMINATION RESULTS OF SAMPLES PREPARED WITH DIFFERENT PREPARATION METHODS/SU Qiong (Laboratory of Industrial Hygiene, Ministry of Public Health, Beijing) (*In Chinese*)

According to condition recommended in references, two bio-samples, the tea leaves and the wheat flour, are prepared with two different methods of ground into powder and reduced to ash. The radionuclides in the samples are analysed by γ speotrometry. The results show that the measured values of tea samples prepared by different method have outstanding difference, and the preparation method of reduced to ash makes some nuclides of the sample lost. Comparing with the nondestructive method of ground into powder samples, the method of reduced to ash could make the detection sensibility much higher, but its suitability for kinds of samples and nuclides has some limitation, so its application have to be careful. At the same time it is shown in the work that developing the study about influence on determination results of samples