CNIC-01169

中国核科技报告

CHINA NUCLEAR SCIENCE AND TECHNOLOGY REPORT

文　摘

ABSTRACTS

1996

中国核情报中心
原子能出版社

China Nuclear Information Centre
Atomic Energy Press

CNIC-01169

中国核科技报告文摘

（1996 年）

ABSTRACTS CHINA NUCLEAR SCIENCE & TECHNOLOGY REPORT（1996）

中国核情报中心
原子能出版社
北京 · 1997. 5

摘　要

文摘包括1996年度出版的《中国核科技报告》（报告号CNIC-01021～CNIC-01130）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1996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 1996 (Report Numbers CNIC-01021～CNIC-01130) 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.

类 目 录

TABLE OF CONTENTS

A00.00 物理科学 PHYSICAL SCIENCES

A10.00 普通物理学 GENERAL PHYSICS …… (1)

A30.00 中子物理学与核物理学 NEUTRON AND NUCLEAR PHYSICS …… (10)

B00.00 化学、材料与地球科学 CHEMISTRY, MATERIALS AND EARTH SCIENCES

B10.00 化学 CHEMISTRY …… (13)

B20.00 材料 MATERIALS …… (23)

B30.00 地球科学 EARTH SCIENCES …… (32)

C00.00 生命科学 LIFE SCIENCES

C10.00 生物学中外照射的所有效应及各种问题 ALL EFFECTS AND VARIOUS ASPECTS OF EXTERNAL RADIATION IN BIOLOGY …… (43)

C20.00 放射性同位素效应及动力学 RADIOISOTOPE EFFECTS AND KINETICS …… (44)

C40.00 应用生命科学 APPLIED LIFE SCIENCES …… (52)

C50.00 保健、辐射防护与环境 HEALTH, RADIATION PROTECTION AND ENVIRONMENT …… (56)

C60.00 辐射学与核医学 RADIOLOGY AND NUCLEAR MEDICINE …… (65)

D00.00 同位素、同位素应用与辐射应用 ISOTOPES, ISOTOPE AND RADIATION APPLICATIONS

D10.00 同位素与辐射源 ISOTOPES AND RADIATION SOURCES …… (66)

D20.00 同位素应用与辐射应用 ISOTOPE AND RADIATION APPLICATIONS …… (67)

E00.00 工程与技术 ENGINEERING AND TECHNOLOGY

E10.00 工程 ENGINEERING …… (68)

E20.00 裂变反应堆（总类） FISSION REACTORS (GENERAL) …… (71)

E30.00 特定裂变堆类型及其有关电站 SPECIFIC FISSION REACTOR TYPES AND THEIR ASSOCIATED PLANTS …… (77)

E40.00 仪器、仪表 INSTRUMENTATION …… (79)

E50.00 废物管理 WASTE MANAGEMENT …… (86)

F00.00 核能其他问题 OTHER ASPECTS OF NUCLEAR ENERGY

F10.00 经济学与社会学 ECONOMICS AND SOCIOLOGY …… (87)
F60.00 其他 MISCELLANEOUS …… (92)

A00.00 物理科学

PHYSICAL SCIENCES

A10.00 普通物理学

GENERAL PHYSICS

A12.00 原子与分子物理学

Atomic and Molecular Physics

CNIC-01059 960001

IAE-0151 **^{58}Co 核 $(\pi g_{9/2}, \upsilon g_{9/2})$ 拉长组态实验研究**/袁 坚 卢 明 陆道如……（中国原子能科学研究院，北京）

寻找原子核拉长态的主要兴趣在于它是一个纯核壳模型组态，它常常被用来定义相应的组态空间大小，确认多核子壳模型计算中的剩余相互作用，并且在全微观三核子转移反应 DWBA 分析中提供好的波函数。实验上观测到的纯壳模波函数并不多，主要是在一些较轻的核上观测到的，此工作的主要目的是在中等重核上观测寻找原子核拉长态。利用 ΔE-E 望远镜及北京 Q3D 磁谱仪系统，在 HI-13 串列加速器提供的 35 MeV α 离子轰击下，测量了 ^{56}Fe (α, d) ^{58}Co 核反应的精细能谱和微分截面角分布。借助全微观 DWBA 理论分析，相应于核反应俘获的 p-n 核子对具有 $(1g_{9/2})^2$ 的组态，观测到迄今所能看到的最高拉长态 $(1g_{9/2}, 1g_{9/2})_9$。还对 6.4 MeV 高激发能级核反应截面的反常增强，p-n 核子对耦合成最小角动量的实验证提进行了讨论（这一点在 s-d 壳核上至今未看到），并且首次确认了 6.4 MeV 能级的自旋宇称 $J^\pi = 1^+$。

EXPERIMENT STUDY OF THE $(\pi g_{9/2}, \upsilon g_{9/2})$ STRETCHED CONFIGURATION IN ^{58}Co /YUAN Jian LU Ming et al. (China Institute of Atomic Energy, Beijing) (*In Chinese*)

The interest of the search for the stretched state stems largely from the fact that these states are usually considered to be of fairly pure nuclear shell model configuration and often used to help define the appropriate configuration space, determine the proper residual interaction in the multi-particle shell model calculation and provide a good wave function for study of three nucleon transfer reaction with fully microscopic DWBA analyses. Actually, only a few pure shell model configurations have been observed in some light nuclei so far. One intends to search for the existence of the stretched state in medium mass. The fine spectra and the angular distri-

butions of differential cross-section strongly excited by 35 MeV α ion bombardment in $^{56}Fe(\alpha,d)^{58}Co$ reaction in HI-13 Tandem Accelerater in terms of ΔE-E telescope and Beijing Q3D magnetic spectrometer have been measured. The stretched state for 6.79 MeV 9^+ with the bighest ($\pi g_{9/2}$, $\upsilon g_{9/2}$) configuration was identified and the 6.4 MeV high-lying level was newly assigned to be 1^+ state in ^{58}Co.

A13.00 固体与流体物理学

Solid State and Fluid Physics

CNIC-01107 960002

ZZU-0002 Mössbauer 效应对几种古代名瓷的应用研究/高正耀 陈松华（郑州大学），申作成（郑州轻工业学院）

分析了宋代和元代著名的汝瓷、钧瓷和官瓷样品，比较了古代和仿古瓷的穆斯堡尔参数，讨论了这些古瓷的烧制技术、着色机理的微观结构，得到了以下结果：(1) 汝瓷釉中含有结构铁 Fe^{2+}，Fe^{3+}和磁性成分 Fe_3O_4。推断宋代和元代汝瓷原始烧成温度约为 1250℃。它们的烧制气氛为还原气氛。汝瓷的釉色与铁的化学状态有关。(2) 钧瓷釉中含有铁矿物（Fe_2O_3，Fe_3O_4）和已进入粘土晶格的结构铁（Fe^{2+}，Fe^{3+}）。推断宋代钧瓷（SJ_2）的原始烧制温度高于 1200℃，元代钧瓷（YJ_3）的原始烧成温度略高于 1250℃。宋代天蓝钧瓷在重还原气氛中烧成。宋代天青钧瓷和仿古蓝钧瓷在中等还原气氛中烧成。元代钧瓷 YJ_3 在弱还原气氛中烧成。推断古钧瓷的 Fe^{2+}和 Fe^{3+}的配位数均为 4。钧瓷的着色机理非常复杂。铁的化学状态是影响钧瓷釉色的因素之一。(3) 南宋官瓷粉青釉与灰青釉中结构铁较多。米黄釉中氧化铁较多。粉青釉和灰青釉的烧制气氛为重还原气氛，烧制温度较高。米黄釉为轻还原气氛，烧成温度较低。

APPLIED INVESTIGATION OF MÖSSBAUER EFFECT FOR THE FAMOUS ANCIENT CHINESE PORCELAINS/GAO Zhengyao CHEN Zuocheng (Zhengzhou University), SHEN Zuocheng (Zhengzbou Institute of Light Industry)

The famous Ru porcelain, Jun porcelain and Guan porcelain of Song Dynasty and Yuan Dynasty are analyzed. The Mössbauer parameters of the ancient porcelains and the imitative ancient porcelains are compared. The firing techniques, coloring mechanism and microstructures of the ancient Chinese porcelains have been discussed. The results are shown as follows: (1) The Ru poreclain glaze contain structure iron (Fe^{2+}, Fe^{3+}) and magnetic component Fe_3O_4. The original firing temperatures of Ru porcelain of Yuan Dynasty and Song Dynasty are inferrd to be 1250 ℃. The original firing atmospheres are determined to be reductive. The glaze color of the Ru porcelain is related to the chemical state of iron. (2) The ancient Jun porcelain glazes contain iron minerals (Fe_2O_3, Fe_3O_4) and structural iron (Fe^{2+},

Fe^{3+}) entered clay mineral lattice. The original firing temperature of Jun porcelain (SJ_2) of Song Dynasty is determined to be above 1200 ℃, the original firing temperature of Jun porcelain (YJ_3) of Yuan Dynasty is a little higher than 1250 ℃. The firing atmosphere of sky-blue Jun porcelain of Song Dynasty is strongly reductive atmosphere. The firing atmosphere of sky-green Jun porcelain of Song Dynasty and the imitative ancient blue Jun porcelain is modestly reductive atmosphere. The firing atmosphere of moon-white Jun porcelain of Yuan Dynasty is weak reductive atmosphere. The coordination numbers of both Fe^{2+} and Fe^{3+} are 4. The coloring mechanism of Jun porcelain is very complex. Iron is only one of the major colorant in Jun porcelain. The chemical state of iron is only one of factors that influence the glaze color of Jun porcelain. (3) The glaze color of Southem Song Guan porcelain is related to the chemical state of iron. The more structure iron content is contained in powder-green glaze as well as greyish-green glaze. The more ferric oxide content is contained in cream-yellow glaze. The firing atmosphere of powder-green glaze and greyish-green glaze is strongly reductive atmosphere, the cream-yellow glaze is to be weak reductive atmosphere. The firing temperature of the former is higher than the later.

A14.00 等离子体物理学与热核反应

Plasma Physics and Thermonuclear Reactions

CNIC-01054 960003

ASIPP-0046 **用电子注入方法实现可控的 L-H 模转换**/潘 垣 汪茂泉 毛剑姗 ……(中国科学院等离子体物理研究所，合肥)

提出了一个不仅可以实现托卡马克运行状态的 H 模式，而且可以对 H 模式随意控制的新方法。理论分析和计算指出，用 $\boldsymbol{E}\times\boldsymbol{B}$ 脉冲漂移注入电子能够触发 H 模，且可避免任何物质装置与等离子体直接接触，同时还可实现 H 模的反馈控制。文章详细给出 1 kHz 频率的可重复的脉冲场和电子束系统，经过仔细计算，完全可满足于 HT-6M 托卡马克实验。

THE CONTROLLABLE L-H TRANSITION REALIZED BY INJECTION OF ELECTRONS/PAN Yuan WANG Maoquan MAO Jianshan et al. (Institute of Plasma Physics, Academia Sinica, Hefei)

A new way to get and control H mode is proposed. Theoretic analysis and calculation show that the electron injection by pulsed $\boldsymbol{E}\times\boldsymbol{B}$ drift can trigger the H mode without direct contact with plasma and could realize the feedback control for the H mode. A repeatable pulsed field and electron beam system with a frequency of 1 kHz that has been demonstrated enough for HT-6M Tokamak experiment are

given in detail.

CNIC-01026 960004

SIP-0088 **MW 等离子体引发单体在聚四氟乙烯表面接枝共聚**/关维恕 文允鉴 方 彦……(核工业西南物理研究院，成都)

研究了 2.45 GHz 微波非平衡等离子体引发单体在聚四氟乙烯材料表面接枝共聚改性。使用 X 射线光电子能谱 (XPS)、衰减全反射富里叶变换红外光谱 (ATR-FTIR) 及扫描电子显微镜 (SEM) 和湿法技术对原始样品及接枝后的样品进行了测试分析。结果表明，接枝后聚四氟乙烯表面的化学结构、成分和形貌均发生了相当大变化，出现了明显的脱氟交联，表面上引入了不同种类和不同含量的含氧功能基团。对样品进行的润湿实验和粘接实验证明，接枝样品表面的亲水性极佳，粘接性也得到了明显改善。分析和实验结果都证实了接枝已获成功。

MICROWAVE PLASMA INITIATED GRAFT COPOLYMERIZATION MODIFICATION OF MONOMERS ONTO PTFE SURFACE/GUAN Weishu WEN Yunjian FANG Yan et al. (Southwestern Institute of Physics, Chengdu)

A graft copolymerization modification technique of monomers onto polytetrafluoroethylene (PTFE) surface initiated by a 2.45 GHz non-equilibrium microwave plasma has been investigated. Standard X-Ray Photoelectron Spectroscopy (XPS), Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy (ATR-FTIR), Scanning Electron Microscopy (SEM) and wetting techniques were used for examination and analysis of samples. Considerable changes in chemical structure, composition and in morphology of grafted surface of PTFE were found. Results showed the occurrence of noticeable defluorination and cross-linked structure on grafted surface, and indicated that different kinds and contents of oxygen-containing functional groups were introduced into the surface of PTFE. Wetting and adhesion experiment of the sample proved that significant improvements in hydrophilicity and adhesion of surface were exhibited. These results confirmed the success of grafting.

CNIC-01034 960005

ASIPP-0045 **托卡马克边界等离子体数值模拟**/陈一平 邱励俭 (中国科学院等离子体物理研究所，合肥)，栾贵时 (中国科学院大恒公司，北京)

用合适的模拟程序，通过数值求解二维多流体等离子体输运方程来模拟托卡马克边界等离子体输运过程和输运特性。模拟结果能显示边界层区域等离子体参数的分布特性，尤其能显示第一壁和偏滤器靶板附近等离子体参量的分布特性。模拟计算的结果对托卡马克偏滤器和第一壁的设计有重要意义。

NUMERICAL SIMULATION OF EDGE PLASMA IN TOKAMAK/CHEN Yip-

ing QIU Lijian (Institute of Plasma Physics, Academia Sinica, Hefei), LUAN Guishi (Da Heng Company, Academia Sinica, Beijing)

The transport process and transport property of plasma in edge layer of Tokamak are simulated by solving numerically two-dimensional and multi-fluid plasma transport equations using suitable simulation code. The simulation results can show plasma parameter distribution characteristics in the area of edge layer, especially the characteristics near the first wall and divertor target plate. The simulation results play an important role in the design of divertor and first wall of Tokamak.

CNIC-01051 960006

SIP-0089 HL-2 中性束注入器离子束系统的设计计算/王惠三 简广德 姜韶风 (核工业西南物理研究院，成都)

在受控核聚变研究中，中性束注入已经成为加热等离子体的有效手段。中性束注入器的关键部分是离子束系统，它的性能决定了中性束注入的效率和效果。文章就大功率中性束注入器离子源及离子引出、加速系统主要工作参数的设计计算方法进行了论述，并给出了 HL-2 装置中性束注入器离子束系统的计算结果。在强流离子束引出、加速系统束光学特性的数值计算程序中，考虑了离子源等离子体参数、等离子体弥散电子及离子束内部空间电荷效应对束光学性能的影响。计算表明，对于设定的 55 keV，80 A 的离子束系统，氢和氘离子束的匹配流密度分别为 0.22 A·cm^{-2}和 0.155 A·cm^{-2}。

DESIGN CALCULATION OF THE ION BEAM SYSTEM FOR HL-2 NEUTRAL BEAM INJECTOR/WANG Huisan JIAN Guangde JIANG Shaofeng (Southwestern Institute of Physics, Chengdu) (*In Chinese*)

In fusion research, the neutral beam injection has become an efficient method for heating plasma. A key part of the neutral beam injector is ion beam system, whose property defines the efficiency and effect of the neutral beam injector. Design calculation method about main work parameters of the ion source and the ion extraction-acceleration system for high power neutral beam injectors are described and the calculated results of the ion beam system for HL-2 neutral beam injector are given. In the numerical calculation code about optical property of the high current ion beam extraction-acceleration systems, the effects of ion source plasma parameters, plasma stray electron and space charge effect inside the ion beam on beam optical property are taken into account. The calculation shows for the determinate 55 keV, 80 A ion beam systems, the match current densities of H and D ion beams are 0.22 A·cm^{-2} and 0.155 A·cm^{-2}, respectively.

CNIC-01064 960007

SIP-0091 非平衡态氧等离子体合成臭氧及其应用的实验研究/段淑云 程仕清 夏 华……(核工业西南物理研究院，成都)

应用寂静放电方法产生非平衡态氧等离子体合成臭氧。在用纯氧作为工作气体时，臭氧质量浓度 C 达 18.9 mg/L，臭氧产率 Q 可达 1800 mg/h，臭氧单能产率 η 为 70 g/(kW·h)(相当于单产能耗 P_y 为 14 kW·h/kg；在以空气为原料气体时，则相应的 $C=12$ mg/L，$Q=730$ mg/h，$\eta=31$ g/(kW·h)($P_y=32$ kW·h/kg)；且 C、Q 均随放电电压的升高而增加，C 随气体流量的增加而减少；电介质性能和厚度，放电电压及频率和波形均对臭氧发生器的性能有明显的影响。臭氧化空气对造纸黑液水溶液的脱色作用明显且经时稳定性良好，放置 118 天后仍无回色现象；可使黑液粘稠度降低到原值的 50%；脱木素率可达 85%。

EXPERIMENTAL INVESTIGATION ON SYNTHESIS OF OZONE IN NON-EQUILIBRIUM OXYGEN PLASMA AND ITS APPLICATION/DUAN Shuyun CHENG Shiqing XIA Hua et al. (Southwestern Institute of Physics, Chengdu) (*In Chinese*)

The synthesis of ozone in non-equilibrium oxygen plasma is performed by using silent discharge method. When oxygen is used as discharge gas, the mass concentration of ozone C is 18.9 mg/L and production rate Q is 1800 mg/h, specific energy rate η is 70 g/(kW·h). When discharge takes place in the air, the results obtained are: $C=12$ mg/L, $Q=730$ mg/h, $\eta=31$ g/(kW·h). The mass concentration of ozone rises with the increase of voltage applied on the electrodes and reduces following the increase of the gas flow rate. But the production rate of ozone rises with the increase of the gas flow rate slightly. The properties of the dielectric material and its thickness will influence the performance of the ozonizer strongly. It is found that raising the frequency of the high voltage power source and using a square wave high voltage can improve the performance of the ozonizer as well. The experimental investigation results show that: ozone can be used in disposal of pulp waste liquor because of its strong oxidizing ability. The effect of decolour is observed and ageing stability is very well and no recolour phenomenon appears after being treated and laying aside for 118 days. Both effects of reducing the viscosity and removing the lignin are obtained as well.

CNIC-01082 960008

SIP-0092 托卡马克中径向电场对新经典输运的影响/王中天(核工业西南物理研究院，四川成都)，G·Le Clair(加拿大聚变中心)

应用哈密顿动力学理论，提出了在径向电场存在情况下的新经典输运理论。在考虑了大电场影响的平台区和考虑了压缩因子的香蕉区后，得到了输运系数。这些因素在等离子

体边界强烈地影响等离子体的输运，得到的有关压缩因子的定标与 Shaing 和 Hazeltine 的定标不同。在刮离层区计算了等离子体的旋转速度，其值与在 TdeV 托卡马克上的测量值很符合。

EFFECTS OF RADIAL ELECTRICAL FIELD ON NEOCLASSICAL TRANSPORT IN TOKAMAKS/WANG Zhongtian (Southwestern Institute of Physics, Chengdu) G • Le Clair (Canada Fusion Centre)

Neoclassical transport theory for tokamaks in the presence of a radial electrical field with shear is developed using Hamiltonian formalism. Diffusion coefficients are derived in both plateau regime including a large electric field and banana regime including the squeezing factor which can greatly affect diffusion at the plasma edge. The scaling on squeezing factor is different from the one given by Shaing and Hazeltine. Rotation speeds are calculated in the scrape-off region. They are in good agreement with measurements on TdeV Tokamak.

CNIC-01090 960009

SIP-0093 SWIP-RFP 装置等离子体环电压和电流测量/李 强 张 鹏 罗萃文 (核工业西南物理研究院，成都)

介绍 SWIP-RFP 装置等离子体环电压和环电流的测量方法和测量结果。对 RFP 环电压模型也作了初步分析，实验中采用单匝线圈测量的环电压很大程度地取决于外电路的电流，这一电压中存在一感应分量，即使考虑了测量环电压的感应分量，RFP 等离子体的环电压也要大于环形磁约束系统等离子体的经典电阻环电压，这是反场箍缩等离子体螺旋量守恒的一个重要课题。对与环电压有关的电磁特性也作了一定研究。测量结果表明，SWIP-RFP 装置的等离子体电流一般大于 60 kA，在较好的放电条件下，等离子体电流可以驱动到 100 kA，等离子体电流最大值时刻的单匝线圈测量的环电压约为250 V。这样的结果与其它方式的估算是相对应的。测量结果还揭示了 RFP 装置大的等离子体电流密度和异常的环电压的存在。

PLASMA TOROIDAL VOLTAGE AND CURRENT MEASUREMENTS ON SWIP-RFP DEVICE/LI Qiang ZHANG Peng LUO Cuiwen (Southwestern Institute of Physics, Chengdu)

The plasma toroidal voltage and toroidal current measurement methods and some results on SWIP-RFP device are presented. The preliminary model for the toroidal voltage of an RFP plasma is analyzed. The toroidal voltage measured with an one turn coil depends largely on the external current, i. e. there is an inducted component in the one turn coil voltage. Even though the inducted component is taken into account, the plasma toroidal voltage for an RFP plasma exceeds the classical resistive toroidal voltage for a toroidally driven system, this is an interesting subject related to the plasma helicity balance for an RFP plasma. The electromagnetic fea-

tures related to the toroidal voltage measurement are studied. The experiments show that the plasma current is above 60 kA normally, with better discharge conditions, the plasma current can be driven to 100 kA. The one turn coil voltage is about 250 V with maximum plasma current during a discharge. These results are consistent with the estimated results via other signals, furthermore, high plasma current density and the existence of anomalous toroidal voltage for the RFP plasma are revealed.

CNIC-01093 960010

SIP-0094 高电流密度 ULQ 等离子体实验研究/张 鹏 李 强 罗萃文……(核工业西南物理研究院，成都)

给出了高电流密度条件下 ULQ 实验的结果。真空室壁经过碳化、硅化等处理得到高温度稳定约束的 ULQ 等离子体。同时观察到“发电机”效应导致环磁通长时间维持增长，反常电阻率和异常离子加热。在不同的充入气体 [He+H_2+SiH_4 和 H_2] 放电中，观察到类同位素效应。

EXPERIMENTAL STUDY OF ULTRA LOW Q PLASMA WITH HIGH CURRENT DENSITY/ZHANG Peng LI Qiang LUO Cuiwen et al. (Southwestern Institute of Physics, Chengdu)

Ultra Low q (ULQ) experimental results with high current density are given. ULQ plasma with fine confinement and high temperature is ohtained after wall carbonization and siliconization. Dynamo effect caused long-period enhancement of toroidal magnetic field, anomalous resistivity and anomalous ion heating are observed. A similar lsotope effect is also observed in discharges with different filling gases [He+H_2+SiH_4 or H_2].

CNIC-01117 960011

SIP-0095 低径比托卡马克等离子体的自然拉长和三角变形/李芳著 张锦华 高庆弟……(核工业西南物理研究院，成都)

研究了不同内感 l_i 和极向比压 β_p 值时，低径比托卡马克等离子体自然拉长 k 和三角变形 δ 与径比 A 的关系。l_i 和 β_p 对 k 的影响可以用“有效”径比来描述。数值结果表明 k 与 l_i 的关系可以用式子 $k=1+g_1(l_i)A^{-2}+g_2(l_i)A^{-4}$ 拟合，而 β_p 对 k 的影响亦不能忽略，尚未找到 δ 与 l_i 的明显关系。

NATURAL ELONGATION AND TRIANGULARITY OF LOW ASPECT RATIO TOKAMAK PLASMA/LI Fangzhu ZHANG Jinhua GAO Qingdi et al. (Southwestern Institute of Physics, Chengdu)

The dependence of the natural elongation k and triangularity δ for low aspect ratio tokamak plasma on the aspect ratio A for different internal inductance l_i and

poloidal beta β_p was investigated numerically. It is found that the effects of l_i and β_p on k can be described in terms of an "effective" aspect ratio. Numerical results sbow that the dependence of k on l_i can be explicitly fitted by an expression $k=1+g_1(l_i)A^{-2}+g_2(l_i)A^{-4}$ and the effect of β_p on k is not negligible. No explicit dependence of δ on l_i and β_p has been found from these results.

CNIC-01130 960012

ASIPP-0048 **托卡马克中电导率和自举电流**/毛剑珊 汪茂泉（中国科学院等离子体物理研究所，合肥）

提出了一个修正的欧姆定律的计算托卡马克中等离子体的电导率。修正的欧姆电流与自举电流相互补偿。理论计算与 TEXT 托卡马克实验比较指出，修正的欧姆定律比经典和新经典理论更接近实验，并且不会像新经典理论那样，出现有效 Z 小于 1 的荒谬结果，并指出扩展新经典理论是不必要的。

ELECTRIC CONDUCTIVITY AND BOOTSTRAP CURRENT IN TOKAMAK/ MAO Jianshan WANG Maoquan (Institute of Plasma Physics, Academia Sinica, Hefei)

A modified Ohm's law for the electric conductivity calculation is presented, where the modified ohmic current can be compensated by the bootstrap current. A comparison of TEXT tokamak experiment with the theories shows that the modified Ohm's law is a more close approximation to the tokamak experiments than the classical and neoclassical theories and can not lead to the absurb result of $Z_{eff}<1$, and the extended neoclassical theory would be not necessary.

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-01030 960013

LMPI-0045 **^{65}Se 半衰期的测定**/徐晓冀 黄文学 马瑞昌……（中国科学院近代物理研究所，兰州）

通过 β 延迟质子发射鉴定出了在 ^{40}Ca（^{28}Si，3n）反应中产生的一个具有 $T_z=-3/2$，$A=4n+1$ 的核素 ^{65}Se。观察到其单质子能量为 3.70±0.08 MeV，实验测定的半衰期为 $9.6^{+5.3}_{-4.1}$ ms，它相应于由 ^{65}Se 基态到 ^{65}As 中最低的 $T=3/2$ 相似态的超允许 β 跃迁和随后由此态到 ^{64}Ge 基态的质子发射。基于这些结果并结合库仑位移能计算，得到 ^{65}Se 的质量剩余为

-33.26 ± 0.25 MeV。

HALF-LIFE DETERMINATION OF ^{65}Se/XU Xiaoji HUANG Wenxue MA Ruichang et al. (Institute of Modern Physics, Academia, Sinica, Lanzhou)

^{65}Se, a nuclide with $T_z=-3/2$, $A=4n+1$ produced in ^{40}Ca (^{28}Si, 3n) reaction was identified via its β-delayed proton emission. A single proton group at 3.70 $\pm$0.08 MeV was observed and its half-life was experimentally determined to be $9.6^{+5.3}_{-4.1}$ ms which was corresponding to superallowed β transition from ground state of ^{65}Se to the isospin analog state, the lowest $T=3/2$ state, in ^{65}As and the subsequent proton emission to the ground state of ^{64}Ge. Based on these results combining with coulomh displacement energy calculation, the mass excess of ^{65}Se was obtained as -33.26 ± 0.25 MeV.

CNIC-01075 960014

CNDC-0018 INDC (CPR)-040/L 核数据进展通讯

COMMUNICATION OF NUCLEAR DATA PROGRESS No. 15 (1996) /YE Bangjiao LIU Tingjin ZHUANG Youxiang et al. (China Nuclear Data Center)

This is the 15th issue of *Communication of Nuclear Data Progress* (CNDP), in which the nuclear data achievements and progress in China during the last year are presented, including measurements of the energy spectrum and angular distributions of protons from stainless steel bombarded by 14.6 MeV neutrons, and of ^{Nat}Ni (n, xα) reaction cross sections; calculating methods is program CCRMN, theoretical calculations of ^{59}Co and ^{90}Zr neutron reaction data, progress in calculation of direct inelastic scattering cross section of neutron, consistent dynamical and statistical description, a set of optical potential parameters of natural zinc; the method and program CABEI for adjusting consistency between natural and its isotope data, production cross sections of ^{18}F, ^{77}Br and ^{186}Re medical radioisotopes, evaluations of H total cross section from 20 MeV to 2 GeV, ^{58,60,61,62,64,Nat}Ni (n, p), ^{59}Co, ^{90}Zr (n, x) and ^{84}Rb decay data, the comparison of gamma-ray spectrum calculation with semi-empirical method and some model codes, nuclear data sheets update for $A=197$ and nuclear high-spin data for $A=174$, 176 and 178; thermal reactor benchmark testing of CENDL-2 and ENDF/B-6; the status of CENDL-2.1 and progress on Chinese Evaluated Nuclear Parameter Lihrary; activities and cooperations on nuclear data in China in 1995.

CNIC-01080 960015

SUINST-0012 快中子在^{7}Li、^{6}Li 核上小角弹性散射截面/万代蓉 戴运生 张 坤

……（四川大学原子核科学技术研究所，成都）

利用伴随粒子飞行时间方法，测量了入射角在5°以下、快中子在^{7}Li、^{6}Li核上弹性散射截面。用蒙特卡洛方法进行了注量率衰减、多次散射和有限角分辨修正。实验结果与理论计算作了比较，截面数据为核工程设计提供了急需的核参数。

CROSS SECTIONS OF SMALL ANGLE FAST NEUTRON ELASTIC SCATTERING ON ^{7}Li AND ^{6}Li NUCLEI /WAN Dairong DAI Yunsheng ZHANG Kun et al. (Institute of Nuclear Science and Technology, Sichuan University, Chengdu) (*In Chinese*)

The elastic scattering cross sections of fast neutrons on ^{7}Li and ^{6}Li nuclei at incident angles below 5° are measured by the associated particle time-of-fight method. The corrections for neutron fluence rate attenuation multiple scattering and finite angle geometry are perfomed by using Monte Carlo method. The experimental results are compared with the theoretical calculations based on the optical model. The results may provide data needed in nuclear engineering design.

CNIC-01083 960016

CNDC-0019 中能质子散裂中子源核子发射与能量沉积的计算/申庆彪 田 野 赵志祥……（中国原子能科学研究院，北京）

给出了用蒙特卡罗方法计算中能质子打在重核靶上产生的散裂中子源的物理图象、计算公式及所用核数据的来源，并对能量为800，1000，1500，2000 MeV的质子打在^{186}W，^{208}Pb，^{232}Th，^{238}U靶上所产生的散裂中子源的中子数、能谱、空间分布、方向分布等进行了计算和分析。在计算中近似考虑了能量守恒，对于核反应结合能、原子核激发能及裂变能根据质量改变进行了计算，所给出的靶内沉积的电离能、原子核反冲能、裂变碎片能为研究靶的冷却问题提供了物理基础。

CALCULATIONS OF NUCLEON EMISSION AND ENERGY DEPOSITION OF SPALLATION NEUTRON SOURCES INDUCED BY INTERMEDIATE ENERGY PROTONS/SHEN Qingbiao TIAN Ye ZHAO Zhixiang et al. (China Institute of Atomic Energy, Beijing) (*In Chinese*)

Monte-Carlo calculations of nucleon emission and energy deposition of spallation neutron sources induced by intermediate energy protons were made. The cascade, evaporation, and fission reaction processes are considered in our calculations. The target materials ^{186}W, ^{208}Pb, ^{232}Th, and ^{238}U and incident proton energies 800, 1000, 1500, and 2000 MeV were chosen which are pencil beam on target axis. The number and spectra of neutrons and protons emitted from different regions of the target surface were calculated. The energy conservation is considered approximately, for which the bind energies are obtained according to the mass changing. The ionization energy induced by protons, nuclear recoil energy in cascade processes, and

fission fragment energy in different regions inside the target are recorded. The calculated results show that the most of the outgoing neutrons are emitted from the front part of the target. Since the target is longer the most of the outgoing neutrons are emitted from 30～150 degrees against the z axis of the target. The calculated results also show that the most part of the deposited ionization energy, nuclear recoil energy, and fission fragment energy are distributed in the front part especially near the z axis of the target.

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-01028 960017

SMI-0010 **金属铍中总碳、化合碳及游离碳测定的方法研究**/杨兴中 朱晓红(四川材料与工艺研究所，成都)

研究了用美国力可CS-344碳硫测定仪测定金属铍中总碳、化合碳及游离碳的方法。总碳测定：以钨粒-铜粒为助熔剂，它与试样的重量比大于20∶1，可获得好的分析结果。当铍中总碳含量为0.050%～0.080%范围时，样品测定的相对标准偏差<10%；用标准钢样加入到铍试样基体中，回收率为94%～106%。游离碳测定：以3 mol/L HCl溶解样品，过滤后进行测定，当铍中游离碳含量为0.006%～0.020%范围时，样品测定的相对标准偏差≤10%。化合碳测定：以总碳量减去游离碳量即得到化合碳量。该方法适用于测定总碳含量为0.050%～1.00%，及测定游离碳含量为0.006%～0.500%的金属铍样品。

THE RESEARCH OF A METHOD FOR DETERMINATION OF TOTAL CARBON, COMBINATION CARBON AND FREE CARBON IN BERYLLIUM METAL/YANG Xingzhong ZHU Xiaohong (Sichuan Institute of Material and Technology, Chengdu) (*In Chinese*)

A method for determination total carbon, combination carbon and free carbon in beryllium metal with LECO CS-344 carbon/sulphur determinator has been stud-