

# **16th International Conference on Positron Annihilation 2012**

## **(ICPA-16)**

**Journal of Physics: Conference Series Volume 443**

**Bristol, United Kingdom  
19-24 August 2012**

**Editors:**

**Ashraf Alam  
Stephen Dugdale**

**Paul Coleman  
Mina Roussenova**

**ISBN: 978-1-62748-675-0  
ISSN: 1742-6588**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© by the Institute of Physics  
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact the Institute of Physics  
at the address below.

Institute of Physics  
Dirac House, Temple Back  
Bristol BS1 6BE UK

Phone: 44 1 17 929 7481  
Fax: 44 1 17 920 0979

[techtracking@iop.org](mailto:techtracking@iop.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

011001 [The 16<sup>th</sup> International Conference on Positron Annihilation \(ICPA-16\)](#) OPEN ACCESS Ashraf Alam, Paul Coleman, Stephen Dugdale and Mina Roussenova

## Papers

### Fundamentals

012001 [Positronium formation in molecular oxygen](#) OPEN ACCESS J Archer, S M Trilov and P G Coleman

012002 [The sub-THz direct spectroscopy of positronium hyperfine splitting](#) OPEN 5  
ACCESS A Miyazaki, T Yamazaki, T Suehara, T Namba, S Asai, T Kobayashi, H Saito, Y Tatematsu, I Ogawa and T Idehara

012003 [A simple shape-free model for pore-size estimation with positron annihilation lifetime spectroscopy](#) OPEN ACCESS K Wada and T Hyodo

### e<sup>+</sup>/Ps interactions with matter

012004 [Exchange and correlation effects in the strongly interacting He-Ps system](#) 13  
ACCESS A Zubiaga, F Tuomisto and M J Puska

### Anti-hydrogen physics

012005 [Trapped antihydrogen: A new frontier in fundamental physics](#) 18  
Madsen (The ALPHA Collaboration)

012006 [Linac-based positron source and generation of a high density positronium cloud for the GBAR experiment](#) OPEN ACCESS L Liszkay, P Comini, C Corbel, P Debu, P Dupré, P Grandemange, P Pérez, J-M Rey, N Ruiz and Y Sacquin

012007  [\$\bar{H}\$  and  \$\bar{H}^+\$  production cross sections for the GBAR experiment](#) 29  
P Comini and P-A Hervieux

### Metals, oxides and theoretical

- 012008 [Vacancy clusters in ultra fine grained metals prepared by severe plastic deformation](#) OPEN ACCESS J Čížek, O Melikhova, Z Barnovská, I Procházka and R K Islamgaliev 33
- 012009 [High-temperature cuprate superconductors studied by x-ray Compton scattering and positron annihilation spectroscopies](#) OPEN ACCESS B Barbiellini 39
- 012010 [Microstructural Characterization of Ferritic/Martensitic Steels by Positron Annihilation Spectroscopy](#) OPEN ACCESS S H Babu, G Amarendra, R Rajaraman and C S Sundar 45
- 012011 [What we can learn from magnetic Compton scattering: application to the determination of spin polarization](#) OPEN ACCESS J A Duffy 51
- 012012 [PALS combined with Charpy-V tests at WWER reactor pressure vessel steels](#) OPEN ACCESS V Slugeň, A Kryukov, M Petriska, J Veterníková, S Sojak, V Sabelová and R Hinca 57
- 012013 [Positron annihilation sites in nano lead sulfide powders](#) Rempel, A A Valeeva, K Sato and N S Kozhevnikova 62
- 012014 [Dielectric properties and structural defects in BaTi<sub>1-x</sub>Sn<sub>x</sub>O<sub>3</sub> ceramics](#) ACCESS Z Lijuan, W Lihai, L Jiandang, C Bin, Z Minglei and Y Bangjiao 66
- 012015 [Positron Annihilation Study of Cs-Deficient Pollucite](#) Guagliardo, E R Vance, K Sudarshan, J Davis, J F Williams, C Ranganathaiah and S Samarin 70
- 012016 [Positron study of alpha particles effect on oxide-dispersion-strengthened steels](#) OPEN ACCESS J Veternikova, V Slugen, S Stancek, J Degmova, V Sabelova, S Sojak, M Petriska and R Hinca 74
- 012017 [Cu Precipitates in Fe Ion Irradiated Fe-Cu Alloys Studied Using Positron Techniques](#) OPEN ACCESS X Z Cao, P Zhang, Q Xu, K Sato, H Tsuchida, G D Cheng, 78

H B Wu, X P Jiang, R S Yu, B Y Wang and L Wei

012018 [Defect studies of ZnO films prepared by pulsed laser deposition on various substrates](#) 82  
OPEN ACCESS O Melikhova, J Čížek, I Procházka, R Kužel, M Novotný, J Bulíř, J Lančok, W Anwand, G Brauer, J Connolly, E McCarthy, S Krishnamurthy and J-P Mosnier

012019 [Vacancy clustering in pure metals: some first principle calculations of positron lifetimes and momentum distributions](#) 86  
OPEN ACCESS C R Luna, C Macchi, A Juan and A Somoza

012020 [Effects of oxide distributed in grain boundaries on microstructure stability of nanocrystalline metals](#) 90  
OPEN ACCESS K Zhou, H Li, J B Pang and Z Wang

012021 [Vacancy Formation Enthalpy in Polycrystalline Depleted Uranium](#) 94  
ACCESS K R Lund, K G Lynn, M H Weber and M A Okuniewski

012022 [Positron annihilation study of free volume in electron irradiated  \$Zr\_{50}Cu\_{40}Al\_{10}\$  bulk glassy alloy: Effects of thermal relaxation before irradiation](#) 98  
OPEN ACCESS N Onodera, A Ishii, A Iwase, Y Yokoyama, K Sato, Q Xu, T Yoshiie and F Hori

012023 [Cavity nucleation and growth during helium implantation and neutron irradiation of Fe and steel](#) 102  
OPEN ACCESS M Eldrup and B N Singh

012024 [Coincidence Doppler Broadening of Positron Annihilation Radiation in Fe](#) 106  
ACCESS E do Nascimento, V R Vanin, N L Maidana and O Helene

012025 [Vacancy-induced hardening in Fe-Al alloys](#) OPEN ACCESS F Lukáč, J Čížek, I Procházka, Y Jirásková, D Janičkovič, W Anwand and G Brauer 110

012026 [Positron annihilation studies of zirconia doped with metal cations of different valence](#) 114  
OPEN ACCESS I Prochazka, J Cizek, O Melikhova, T E Konstantinova, I A Danilenko, I A Yashchishyn, W Anwand and G Brauer

- 012027 [Effect of carbon on copper precipitation in deformed Fe-based alloys studied by positron annihilation spectroscopy](#) OPEN ACCESS S Zhang, H Schut, E Brück, S van der Zwaag and N H van Dijk 118
- 012028 [Skyrmion-like Solitons and Topological Quasi-positronium in Graphite-potassium Intercalation Compounds](#) OPEN ACCESS M Saito, T Sasaki and I Kanazawa 122
- 012029 [Positron annihilation study of the Mg-Zn-Y alloys with long period stacking ordered \(LPSO\) structures](#) OPEN ACCESS H X Xu, K Inoue, Y Nagai, T Toyama, Y Matsukawa, A Kuramoto, D Egusa, E Abe and B J Ye 126
- 012030 [Monovacancies and Na substitutional defects in PbTe: theoretical positron annihilation study](#) OPEN ACCESS J D Liu, B Cheng, L J Zhang, J Zhang, H M Weng and B J Ye 130
- 012031 [Vacancy migration process in F82H and Fe-Cr binary alloy using positron annihilation lifetime measurement](#) OPEN ACCESS K Sato, Q Xu, D Hamaguchi, S S Huang and T Yoshiie 134
- 012032 [Defect investigations of an iron-nickel meteorite](#) OPEN ACCESS P Parz, M Leitner, W Sprengel, H Reingrubler and W Puff 138
- 012033 [Comprehensive defect characterization of different iron samples after severe plastic deformation](#) OPEN ACCESS W Puff, X Zhou, B Oberdorfer, B Scherwitzl, P Parz, W Sprengel and R Würschum 142
- 012034 [Helium implanted RAFM steels studied by positron beam Doppler Broadening and Thermal Desorption Spectroscopy](#) OPEN ACCESS I Carvalho, H Schut, A Fedorov, N Luzginova, P Desgardin and J Sietsma 148
- 012035 [Effect of heterogeneous distributed intermetallic precipitates on accumulation of vacancy-like defects in irradiated Fe-Ni-based alloys studied by positron annihilation](#) OPEN ACCESS D A Perminov, A P Druzhkov and V L Arbuzov 152
- 012036 [PLEPS study of ion implanted and annealed Fe-11.62%Cr alloys](#) ACCESS S Sojak, V Slugeň, W Egger, L Ravelli, M Petriska, S Stanček, M Sahul, M 156

Skarba, P Priputen, M Stacho, J Vaterníková, R Hinca and V Sabelová

012037 [Effects of proton irradiation on Chinese domestic RPV steels by variable energy positron annihilation spectroscopy](#) OPEN ACCESS J Jiang, Y C Wu, S J Wang, X B Liu and R S Wang 160

012038 [Surface states and annihilation characteristics of positrons trapped at the oxidized Cu\(100\) surface](#) OPEN ACCESS N G Fazleev and A H Weiss 164

012039 [Defects structure characterization of NiMnGa alloys by PALS](#) 168  
D Merida, J A Garcia, F Plazaola, V Sanchez-Alarcos, J I Pérez-Landazábal and V Recarte

### Semi-conducting solids

012040 [Nano sulfide and oxide semiconductors as promising materials for studies by positron annihilation](#) OPEN ACCESS P M G Nambissan 172

012041 [Observation of spatial distribution of vacancy defects in semiconductor by positron microscope and electron beam induced current measurement](#) OPEN ACCESS M Maekawa and A Kawasuso 178

012042 [Acceptors in undoped GaSb; the role of vacancy defects](#) OPEN ACCESS J Kujala, J Slotte and F Tuomisto 182

012043 [In-situ positron lifetime spectroscopy of radiation damage by simultaneous irradiation of slow-positron and ion beams](#) OPEN ACCESS A Kinomura, R Suzuki, T Ohdaira, N Oshima, B E O'Rourke and T Nishijima 186

### Polymers and soft matter

012044 [PALS: A unique probe for the molecular organisation of biopolymer matrices](#) 190  
OPEN ACCESS M Roussenova and M A Alam

012045 [Positron lifetime study of poly\(dimethylsiloxane\) based polymer-nanoparticle composites](#) OPEN ACCESS D J Hughes, M V Roussenova, P Beavis, A C Swain and M

A Alam

012046 [Study of bicontinuous phase in \(TTAB+pentanol\)/water/n-octane reverse micellar system using positron lifetime spectroscopy](#) OPEN ACCESS K C Singh, R Yadav and P H Khani

012047 [Positron annihilation lifetime study of interfaces in ternary polymer blends](#) 204  
OPEN ACCESS D Meghala, P Ramya, T Pasang, J M Raj, C Ranganathaiah and J F Williams

012048 [Interface profile studies in immiscible and partially miscible binary polymer blends from free volume measurement](#) OPEN ACCESS P Ramya, D Meghala, T Pasang, J M Raj, C Ranganathaiah and J F Williams

012049 [Investigation of microstructure and conducting mechanism of nanocomposite polymeric electrolytes with rectorite clay by PALS](#) OPEN ACCESS S Gao, J Gong, X L Yan, G B Xue, J Zhong and B Wang

012050 [Vacancy profile in reverse osmosis membranes studied by positron annihilation lifetime measurements and molecular dynamics simulations](#) OPEN ACCESS A Shimazu, H Goto, T Shintani, M Hirose, R Suzuki and Y Kobayashi

012051 [Infiltration and Selective Interactions at the Interface in Polymer-Oxide Hybrid Solar Cells](#) OPEN ACCESS R Ferragut, S Aghion, F Moia, M Binda, E V Canesi, G Lanzani and A Petrozza [doi:10.1088/1742-6596/443/1/012051](#) [Tag this article](#) [Abstract](#) [References](#) [Full text PDF \(469 KB\)](#)

012052 [Degradation process of fuel cell membrane observed by positron](#) 224  
ACCESS Y Honda, Y Aoyagi, S Tojo, G Watanabe, Y Akiyama and S Nishijima  
[doi:10.1088/1742-6596/443/1/012052](#) [Tag this article](#) [Abstract](#) [References](#) [Full text PDF \(747 KB\)](#)

012053 [Free volumes studies in Thymoquinone and Carvone  \$\beta\$ -cyclodextrin nanoparticles by positron annihilation lifetime spectroscopy](#) OPEN ACCESS M F F Marques, P M Gordo and A M da Silva [doi:10.1088/1742-6596/443/1/012053](#) [Tag this article](#) [Abstract](#) [References](#) [Full text PDF \(339 KB\)](#)

012054 [Positron annihilation lifetime spectroscopy of mechanically milled protein fibre powders and their free volume aspects](#) OPEN ACCESS K Patil, S Sellaiyan, R

Rajkhowa, T Tsuzuki, T Lin, S V Smith, X Wang and A Uedono

012055 [Positron annihilation lifetime spectroscopy study on epoxy moisture absorption](#) 236  
OPEN ACCESS P M Gordo, J M M Luis, M F F Marques, M D Naia and J J M Morais

012056 [A nanostructural investigation of the effect of glycerol on the molecular packing, thermodynamic state and water sorption behaviour of glassy gelatin films](#) 240  
OPEN ACCESS P Díaz-Calderón, M Roussenova, J Enrione and M A Alam

## Liquids

012057 [Account of the intratrack radiolytic processes for interpretation of the AMOC spectrum of liquid water](#) 244  
OPEN ACCESS D S Zvezhinskiy, M Butterling, A Wagner, R Krause-Rehberg and S V Stepanov

012058 [Observations of the growth and sublimation of water ice films by variable-energy positron annihilation spectroscopy](#) 248  
OPEN ACCESS S Townrow, P G Coleman, Y C Wu, J Jiang and S J Wang

012059 [PALS and DSC study of nanopores partially filled by hexadecane](#) 252  
ACCESS O Šauša, E Illeková, J Krištiak, D Berek and E Macová

012060 [Positronium bubble formation in room temperature ionic liquids](#) 256  
T Hirade and T Oka

## Porous and layered structures

012061 [Study of Positronium formation in nano-channelled silicon as a function of sample temperature](#) 260  
OPEN ACCESS S Mariazzi, L DiNoto, L Ravelli, W Egger and R S Brusa

012062 [Ortho-positronium localization in pores of Vycor glass at low temperature](#) 266  
ACCESS R Zaleski

012063 [Positron Annihilation Studies of Mesoporous Silica MCM-41](#) OPEN ACCESS J 273  
F Williams, P Guagliardo, K Sudarshan, C Ranganathaiah, G Koutsantonis, N Hondow

and S Samarin

012064 [Production and thermalization of positronium in homogeneous porous silica](#) 277  
OPEN ACCESS S Aghion, R Ferragut, F Moia, M P Petkov and S M Jones

012065 [Positron annihilation characteristics in multi-wall carbon nanotubes with different average diameters](#) 281  
OPEN ACCESS L A Tuyen, Z Kajcsos, K Lázár, T D Tap, D D Khiem and P T Phuc

012066 [Tuning porosity of silica films by using various surfactants and changing their loading: A study of positron annihilation Doppler broadening based on a slow positron beam](#) 285  
OPEN ACCESS B Xiong, W Mao and C He

### e<sup>+</sup> beam developments

012067 [Material characterization for advanced Si LSI process technology by means of positron annihilation](#) 289  
OPEN ACCESS A Uedono, N Oshima, T Ohdaira, R Suzuki and S Ishibashi

012068 [Reflection high-energy positron diffraction: the past 15 years and the future](#) 295  
OPEN ACCESS Y Fukaya, M Maekawa, I Mochizuki, K Wada, T Hyodo and A Kawasuso

012069 [Monte Carlo simulations of the extraction of slow positrons into gas through thin SiN windows](#) 301  
OPEN ACCESS B E O'Rourke, W Zhou, N Oshima, K Ito and R Suzuki

012070 [Positron Re-emission Studies from W \(100\)](#) OPEN ACCESS K Sudarshan, V N 307  
Petrov, S N Samarin, P Guagliardo, A H Weiss and J F Williams

012071 [In-situ \(C\)DBS at high temperatures at the NEPOMUC positron beam line](#) 311  
ACCESS M Reiner, P Pikart and C Hugenschmidt

012072 [Flash lamp annealing of tungsten surfaces marks a new way to optimized slow positron yields](#) 315  
OPEN ACCESS W Anwand, J M Johnson, M Butterling, A Wagner, W

Skorupa and G Brauer

012073 [Optimization of growth parameters of TiO<sub>2</sub> thin films using a slow positron beam](#) 319  
OPEN ACCESS M Butterling, W Anwand, S Cornelius, K Potzger, A Smekhova, M Vinnichenko and A Wagner

012074 [Optimization of a multi-ring detector for Ps time of flight measurements](#) 323  
ACCESS L D Noto, M Benetti, S Mariazzi, G-F D Betta and R S Brusa

012075 [Efficient emission of positronium atoms from an Na-coated polycrystalline tungsten surface](#) 327  
OPEN ACCESS H Terabe, S Iida, K Wada, T Hyodo, A Yagishita and Y Nagashima

012076 [Study of Neutron Induced Defects in Ceramics using the GiPS Facility](#) 331  
ACCESS S May-Tal Beck, M Butterling, W Anwand, A Beck, A Wagner, G Brauer, A Ocherashvili, I Israelashvili and O Hen

012077 [Status of the Linac based positron source at Saclay](#) OPEN ACCESS J-M Rey, G Coulloux, P Debu, H Dzitko, P Hardy, L Liszkay, P Lotrus, T Muranaka, C Noel, P Pérez, O Pierret, N Ruiz and Y Sacquin

012078 [Measurement of the Positron Annihilation Induced Auger Electron Spectrum from Ag\(100\)](#) OPEN ACCESS P Joglekar, K Shastry, N G Fazleev and A H Weiss

## Advances in techniques

012079 [The Upgrade of the Neutron Induced Positron Source NEPOMUC](#) 343  
ACCESS C Hugenschmidt, H Ceeh, T Gigl, F Lippert, C Piochacz, P Pikart, M Reiner, J Weber and S Zimnik

012080 [Fast inorganic scintillators – status and outlook](#) OPEN ACCESS R W Novotny 350

012081 [Positron beams from small accelerators and status of a novel positron storage project](#) OPEN ACCESS M H Weber, B D Riley, C J Baker and K G Lynn

012082 [New experiment stations at KEK Slow Positron Facility](#) OPEN ACCESS K 362  
Wada, T Hyodo, T Kosuge, Y Saito, M Ikeda, S Ohsawa, T Shidara, K Michishio, T  
Tachibana, H Terabe, R H Suzuki, Y Nagashima, Y Fukaya, M Maekawa, I Mochizuki  
and A Kawasuso

012083 [The Bristol HIDAC 2D-ACAR Spectrometer](#) OPEN ACCESS S B Dugdale, J 368  
Laverock, C Utfeld, M A Alam, T D Haynes, D Billington and D Ernsting

012084 [Spin-polarized positron annihilation spectroscopy for spintronics applications](#) 374  
OPEN ACCESS A Kawasuso, Y Fukaya, M Maekawa, I Mochizuki and H Zhang

012085 [A TOF-PET Detector based on Quadrant-Sharing PMTs and Optimized Leading-edge Timing Method](#) OPEN ACCESS Y Wang, J Liu, D Li, T Zhang, Z Zhang, X Cao, B  
Wang and L Wei

012086 [QtCDB2 software for coincidence Doppler broadening measurement system](#) 382  
OPEN ACCESS M Petriska, V Slugeň, V Sabelová, S Soják and J Veterníková

012087 [Software for analysis of waveforms acquired by digital Doppler broadening spectrometer](#) 386  
OPEN ACCESS M Vlček, J Čížek and I Procházka

012088 [First Experiments with MePS](#) OPEN ACCESS M Jungmann, J Haeberle, R 390  
Krause-Rehberg, W Anwand, M Butterling, A Wagner, J M Johnson and T E Cowan

012089 [Determination of electron binding energies in two-dimensional Coincident Doppler Broadening spectra](#) 394  
OPEN ACCESS P Pikart and C Hugenschmidt

012090 [Development of a sample chamber with humidity control for an atmospheric positron probe microanalyzer](#) 398  
OPEN ACCESS W Zhou, N Oshima, Z Chen, K Ito, B E O'Rourke, R Kuroda, R Suzuki, H Yanagishita, T Tsutsui, A Uedono and N Hayashizaki

012091 [Position-resolved Positron Annihilation Lifetime Spectroscopy](#) 402  
A Wagner, M Butterling, F Fiedler, F Fritz, M Kempe and T E Cowan

012092 [First 2D-ACAR Measurements on Cu with the new Spectrometer at TUM](#) 406  
ACCESS J A Weber, P Böni, H Ceeh, M Leitner and C Hugenschmidt

012093 [A novel setup for the pulsing and energy enhancement of a positron beam](#) 410  
ACCESS C Piochacz and C Hugenschmidt

012094 [First measurements with the Munich 2D-ACAR spectrometer on Cr](#) 414  
ACCESS H Ceeh, J Weber, C Hugenschmidt, M Leitner and P Böni

012095 [Development of a new time and position resolving detector for the pulsed low energy positron system PLEPS](#) OPEN ACCESS U Ackermann, W Egger, P Sperr, B Löwe, L Ravelli, G Kögel, G Dollinger and O Jagutzki

012096 [Geant4 simulation of the effect of backscattered positrons on the lifetime spectra of PLEPS](#) OPEN ACCESS L Ravelli, B Löwe, W Egger, G Kögel, P Sperr and G Dollinger

012097 [Positron annihilation lifetime spectroscopy based on secondary electron emission from carbon foil](#) OPEN ACCESS C K Ng, B Yang and S Fung

012098 [A position sensitive germanium detector for the measurement of angular deviation of annihilation radiation](#) OPEN ACCESS B Löwe, M Reiner, W Egger, C Hugenschmidt and G Dollinger

012099 [Optimization of the Scintillator Size for Positron Lifetime Measurements](#) 434  
ACCESS M Yamawaki, Y Kobayashi, K Hattori and Y Watanabe