

APPENDIX A

Listing of the batch Program for the PCA Multiport multichannel analyser to save spectra automatically after a predefined number of energy scans. The 'preset passes' sets the number of scans after which to save. The number after 'loop begin' tells how often to save. In the example below 10 scans are acquired the spectrum of each scan is saved. The filenames are numbered and incremented before saving. As an optional feature it is possible to save the files under the same name by not incrementing the file number. This batch program has to be compiled with the build in compiler before it can be started.

```

CONFIRM "START OF NRA, PRESS ANY KEY TO CONTINUE."
COLLECT "PLEASE ENTER FILENAME: " %F TONE LEN 7

MCS EXTERNAL      ; EXTERNAL DWELL
SYNC EXTERNAL
LOOP BEGIN 10     ; THIS NUMBER TELLS HOW OFTEN TO SAVE
ACQUIRE
PRESETS ON
PRESET PASSES 1   ; THIS NUMBER TELLS AFTER HOW MANY SCANS TO SAVE
WAIT              ; WAIT FOR PRESETS TO ELAPSE
STEP FILENAME 1   ; INCREMENT THE FILENAME BY ONE NUMBER
ID %F            ; UPDATE THE ID STRING
SAVE %F OVERWRITE ; SAVE THE DATA TO A BINARY DISK FILE
LOOP END

STOP

CONFIRM "END OF NRA ACQUISITION, STRIKE ANY KEY TO CONTINUE."

```

REFERENCES

- [1] W.C. Roberts-Austen, *Phil. Trans. Roy. Soc. (London)*, A 187 (1896) 404.
- [2] L.W. Barr, *Defect and Diffusion Forum*, 143-147 (1997) 3.
- [3] C. Tuijn, *Defect and Diffusion Forum*, 143-147 (1997) 11.
- [4] K.N. Tu, *Ann. Rev. Mater. Sci.*, 15 (1985) 147.
- [5] A. Fick, *Ann. Phys. Lpz.*, 170 (1855) 59.
- [6] A. Fick, *Phil. Mag.*, 10 (1855) 30.
- [7] R.M. Barrer, *Diffusion in and through solids*, Cambridge press, Cambridge England, (1951) 3.
- [8] A. Seeger and P.K. Chik, *Phys. Stat. Sol*, 29 (1968) 455.
- [9] S.J. Pearton, *Int. Journ. of Mod. Phys. B*, Vol 7, 28 (1993) 4687.
- [10] J. Crank, *The Mathematics of Diffusion*, 2nd ed. , Clarendon Press, Oxford, (1975) 186.
- [11] J.R. Kaschny, private communication.
- [12] D. Fink, R. Klett, M. Behar, G. Sánchez, J.R. Kaschny, and W.G. Hertlein, *Nucl. Inst. and Meth.*, B132 (1997) 660.
- [13] J.R. Tesmer and M. Nastasi, *Handbook of Modern Ion Beam Materials Analysis*, Mat. Res. Soc. Pittsburgh, Pennsylvania, (1995) 5.
- [14] J.P. Biersack and L.G. Haggmark, *Nucl. Instr. and Meth.*, 174 (1980) 257.
- [15] S. Kalbitzer and H. Oetzmann, *Phys. Lett.*, 59A (1976) 197.
- [16] J.F. Ziegler, J.P. Biersack and U. Littmark, *The Stopping and Ranges of Ions in Matter (Vol.1)*, Pergamon Press, New York, (1985).
- [17] J.P. Biersack and J.F. Ziegler, in *Ion Implantation Techniques*, ed. H. Ryssel and H. Glawischnig, Springer Verlag Berlin, (1982) 148.
- [18] J. Lindhard and M. Scharff, *K. Dan. Vidensk. Selsk. Mat. Fys. Medd.*, 27 (1953) No.15.
- [19] J. Lindhard and M. Scharff, *Phys Rev.* 124 (1961) 128.
- [20] J. Lindhard, M. Scharff, and H.E. Schiott, *K. Dan. Vidensk. Selsk. Mat. Fys. Medd.*, 33 (1961) No.14.
- [21] N. Bohr, *Phil. Mag.*, 25 (1913) 10.
- [22] H.A. Bethe, *Ann. Phys.*, 5 (1930) 325.
- [23] F. Bloch, *Ann. Phys.*, 16 (1933) 285.
- [24] H. Bichsel, *ICRU Report*, 37 (1984).

- [25] N. Bohr, Phys. Rev., 58 (1940) 654.
- [26] N. Bohr, Phys. Rev., 59 (1941) 270.
- [27] J.F. Ziegler and J.M. Manoyan, Nucl. Inst. and Meth., B35 (1988) 215.
- [28] W.K. Chu, J.W. Mayer and M.A. Nicolet, Backscattering Spectrometry, Academic Press, New York (1978) 45.
- [29] N. Bohr, Mat. Fys. Medd. Dan. Vid. Selsk, 18 (1948) 8.
- [30] N. Bohr, Mat. Fys. Medd. Dan. Vid. Selsk, 24 (1948) 19.
- [31] J.R. Tesmer and M. Nastasi, Handbook of Modern Ion Beam Materials Analysis, Mat. Res. Soc., Pittsburgh, Pennsylvania, (1995) 37.
- [32] T. Mayer-Kuckuck, Kernphysik, Teubner Verlag, (1984) 344.
- [33] J.M. Blatt and V.F. Weisskopf, Theoretical Nuclear Physics, John Wiley and Sons Inc., New York, (1952).
- [34] T. Mayer-Kuckuck, Kernphysik, Teubner Verlag, (1984) 99.
- [35] J.R. Tesmer and M. Nastasi, Handbook of Modern Ion Beam Materials Analysis, Mat. Res. Soc., Pittsburgh, Pennsylvania, (1995) 170.
- [36] E. Friedland, Nucl. Inst. and Meth., 150 (1978) 301.
- [37] G.Amsel, J.P. Nadai, E. d'Artemare, D. Davis, E. Girard and J. Moulin, Nucl. Instr. and Meth., 92 (1971) 418.
- [38] G. Amsel, E. d'Artemare and E. Girard, Nucl. Inst. and Meth., 191 (1981) 189.
- [39] G. Amsel, E. d'Artemare and E. Girard, Nucl. Inst. and Meth., 205 (1983) 5.
- [40] The Energy Scanning System of the University of Pretoria, Users Manual (1993).
- [41] M.Hayes, PhD Thesis, University of Pretoria, (1995) 38.
- [42] J.R. Tesmer and M. Nastasi, Handbook of Modern Ion Beam Materials Analysis, Mat. Res. Soc., Pittsburgh, Pennsylvania, (1995) 186.
- [43] J.R. Tesmer and M. Nastasi, Handbook of Modern Ion Beam Materials Analysis, Mat. Res. Soc., Pittsburgh, Pennsylvania, (1995) 173.
- [44] I. Vickbridge and G. Amsel, Nucl. Inst. and Meth., B45 (1990) 16.
- [45] M.Hayes, PhD Thesis, University of Pretoria, (1995) 47.
- [46] M.A. Meyer and N.S. Wolmarans, Nucl. Phys., A136 (1969) 663.
- [47] L.C. Feldman and J.W. Mayer, Fundamentals of Surface and Thin Film Analysis, Elsevier Science Publishing, New York, (1986) 100.
- [48] D.S. Gemmel, Rev. Mod. Phys., 46 (1974) 129.

- [49] L.C. Feldman, J.W. Mayer and S.T. Picraux, *Material Analysis by Ion Channeling*, Academic Press, New York, (1982).
- [50] D.V. Morgan, *Channeling*, John Wiley and Sons, New York, 1973.
- [51] W.K. Chu, J.W. Mayer and M.A. Nicolet, *Backscattering Spectrometry*, Academic Press, New York (1978) 223.
- [52] J.R. Tesmer and M. Nastasi, *Handbook of Modern Ion Beam Materials Analysis*, Mat. Res. Soc., Pittsburgh, Pennsylvania, (1995) 231.
- [53] T. Hauser, *Diplomarbeit*, Karlsruhe, (1993) 20.
- [54] S.M. Myers, S.T. Picraux and T.S. Preveder, *Phys. Rev. B* 9, 10 (1974) 3953.
- [55] J.L. Murray and A.J. McAllister, *Bull. Alloy Phase Diagrams*, 5(1) Feb. 1984, in: *Binary Alloy Phase Diagrams*, Ed. T.B Massalski, J.L. Murray, L.H. Bennett and H. Baker, Am. Soc. for Metals, Ohio, (1986) 164.
- [56] D. de Cogan, in: *Properties of Silicon*, EMIS Datareviews Series No 4, INSPEC, (1988) 337.
- [57] C.S. Fuller and J.A. Ditzenberger, *J. Appl. Phys.*, 27 (1956) 544.
- [58] B. Goldstein, *Bull. Am. Phys. Soc. Ser. II*, 1 (1956) 145.
- [59] R.C. Miller and A. Savage, *J. of Appl. Phys.*, 27 (1956) 1430.
- [60] Y.C. Kao, *Electrochem. Technol.*, 5 (1967) 90.
- [61] R.N. Goshtagore, *Phys. Rev. B*, 3 (1971) 2507.
- [62] W. Rosnowski, *J. Electrochem. Soc.*, 125 (1978) 957.
- [63] G. Galvagno, F. La Via, F. Priolo and E. Rimini, *Semicond. Sci. Technol.*, 8 (1993) 488.
- [64] A. La Ferla, L. Torrisi, G. Galvagno, E. Rimini, G. Ciavola, A. Carnera and A. Gasparotto, *Appl. Phys. Lett.*, 62 (1993) 393.
- [65] P. Brüesch, E. Halder, P. Kluge, J. Rhyner, P. Roggwiler, Th. Stockmeier, F. Stucki and H.J. Wiesmann, *J. Appl. Phys.*, 68 (1990) 2226.
- [66] H.R. Chang, N. Lewis, G.A. Smith E.L. Hall and V.A.K. Temple, *J. Electrochem. Soc.*, 135 (1988) 252.
- [67] M. Watanabe, O. Ishiwata, M. Nagano and H. Kirihata, *J. Electrochem. Soc.*, 138 (1991) 3427.
- [68] U. Kuhlmann, D. Nagel and R. Dittig, *Defect and Diff. Forum*, 143-147 (1997) 1009.
- [69] R. Baron, G.A. Shifrin, O.J. Marsh and J.W. Mayer, *J. Appl. Phys.*, 40 (1969) 3702.

- [70] A.J. McAllister and J.L. Murray, *Bull. Alloy Phase Diagrams*, 5(4) Aug. 1984, in: *Binary Alloy Phase Diagrams*, Ed. T.B Massalski, J.L. Murray, L.H. Bennett and H. Baker, Am. Soc. for Metals, Ohio, (1986) 117.
- [71] P. Dorner, W. Gust, A. Lodding, H. Odelius, B. Predel and U. Roll, *Acta Metall.*, 30 (1982) 941.
- [72] W. Meer and D. Pommerrenig, *Z. angew. Phys.*, 23 (1967) 369.
- [73] U. Gösele, T.Y. Tan, M. Schultz, U. Egger, P. Werner, R. Scholz and O. Breitenstein, *Defect and Diff. Forum*, 143-147 (1997) 1079.
- [74] L.L. Chang and A. Koma, *Appl. Phys. Lett.*, 29 (1976) 138.
- [75] T.E. Schlesinger and T. Kuech, *Appl. Phys. Lett.*, 49 (1986) 519.
- [76] P. Mei, H.W. Yoon, T. Venkatesan, S.A. Schwarz and J.P. Harbison, *Appl. Phys. Lett.*, 50 (1987) 1823.
- [77] L. Wang, L. Hsu, E.E. Haller, J.W. Erickson, A. Fischer, K. Eberl and M. Cardona, *Phys. Rev. Lett.*, 76 (1996) 2342.
- [78] B. Goldstein, *Phys. Rev.*, 121 (1961) 1305.
- [79] P.M. Petroff, *J. Vac. Sci. Technol.*, 14 (1977) 973.
- [80] R.M. Fleming, D.B. McWhan, A.C. Gossard, W. Wiegmann and R.A. Logan, *J. Appl. Phys.*, 51 (1980) 357.
- [81] H.D. Palfrey, M. Brown and A.F.W. Willoughby, *J. Electrochem. Soc.*, 128 (1981) 2224.
- [82] T.Y. Tan, U. Gösele and S. Yu, *Crit. Rev. Solid State Mater. Science*, 17 (1991) 47.
- [83] A. Yamada, Y. Makita, K.M. Mayer, T. Iida, H. Yoshinaga, S. Kimura, S. Niki, H. Shibata, S. Uekusa and T. Matsumori, *Nucl. Inst. and Meth.*, B80/81 (1993) 910.
- [84] D.E. Davis, *J. of Crystal Growth*, 54 (1981) 150.
- [85] E. Michel, H. Mohseni, J.D. Kim, J. Wojkowski, J. Sandven, J. Xu, M. Razeghi, R. Bredthauer, P. Vu, W. Mitchel and M. Ahoujja, *Appl. Phys. Lett.*, 71 (1997) 1071.
- [86] P. Martin, E. Ligeon and J.P. Gailliard, *Nucl. Inst and Meth.*, 197 (1982) 47.
- [87] V.K. Vasil'ev, O.N. Gorshkov, Y.A. Danilov and V.S. Tulovchikov, *Sov. Phys. Solid State*, 25 (1983) 118.
- [88] G.L. Destefanis, J.P. Belle, J.M. Ogier-Collin and J.P. Gailliard, *Nucl. Inst. and Meth.*, 182/183 (1981) 637.

- [89] D.V. Morgan, F.H. Eisen and A. Ezis, *IEE Proc.*, 128 (1981) 109.
- [90] M. Hansen, in: *Binary Alloy Phase Diagrams*, Ed. T.B Massalski, J.L. Murray, L.H.Bennett and H. Baker, Am. Soc. for Metals, Ohio, (1986) 202.
- [91] D.K. Sadana, *Nucl. Inst and Meth.*, B7/8 (1985) 375.
- [92] D.K. Sadana, M. Strathman, J. Washburn, G.R Booker and M.H. Badawi, *Mat. Res. Soc. Symp. on Defects in Semiconductors*, eds. J. Narayan and T.Y. Tan, (Nov 1980) 515.
- [93] E. Friedland, N.G. van der Berg, J. Hanßmann and O. Meyer, *Surf. and Coatings Techn.*, 83 (1996) 10.
- [94] A.G. Foyt, F.J. Leonberger and R.C. Williamson, *Appl. Phys. Lett.*, 40 (1982) 447.
- [95] S.S. Gill and B.J. Ealy, *J. Appl. Phys.*, 56 (1984) 1189.
- [96] D.E. Davis, J.P. Lorenzo, T.G. Ryan and J.J. Fitzgerald, *Appl. Phys. Lett.*, 35 (1979) 631.
- [97] D.E. Davis, *J. of Crystal Growth*, 54 (1981) 150.
- [98] D.E. Davis, E.F. Kennedy, J.J. Comer and J.P. Lorenzo, *Appl. Phys.Lett.*,36 (1980) 922.
- [99] M. Kruer, L. Esterowitz, R. Allen and F. Bartoli, *Infrared Physics*, 16 (1976) 375.
- [100] *Binary Alloy Phase Diagrams*, Ed. T.B Massalski, J.L. Murray, L.H.Bennett and H. Baker, Am. Soc. for Metals, Ohio, (1986) 1395.
- [101] N.A. Skakun, I.G. Stoyanova, N.P. Dikil, P.A. Svetashev, A.S. Trokhin and A.L. Chapkevich, *Sov. Phys. Semicond.*, 15 (1981) 1112.
- [102] F.D. Auret, *J. Electrochem. Soc.*, Vol. 129, 12 (1982) 2752.
- [103] L.F. Mondolfo, *Aluminium Alloys: Structure and Properties*, Butterworth, England (1976) 552.
- [104] L.F. Mondolfo, *Aluminium Alloys: Structure and Properties*, Butterworth, England (1976) 431.
- [105] G. Petzow and G. Effenberg, *Ternary Alloys, Vol(3)*, VCH Publishers, New York, (1993) 254.
- [106] P. Müller, W. Wesch, V.S. Solovyev, P.I. Gaiduk, E. Wendler, F.F. Komarov and G. Götz, *Nucl. Inst and Meth.*, B80/81 (1993) 721.
- [107] L.F. Mondolfo, *Aluminium Alloys: Structure and Properties*, Butterworth, England (1976) 552.
- [108] A. Föhl, R.M. Emrick and H.D. Carstanjen, *Nucl. Inst. and Meth.*, 65 (1992) 335.