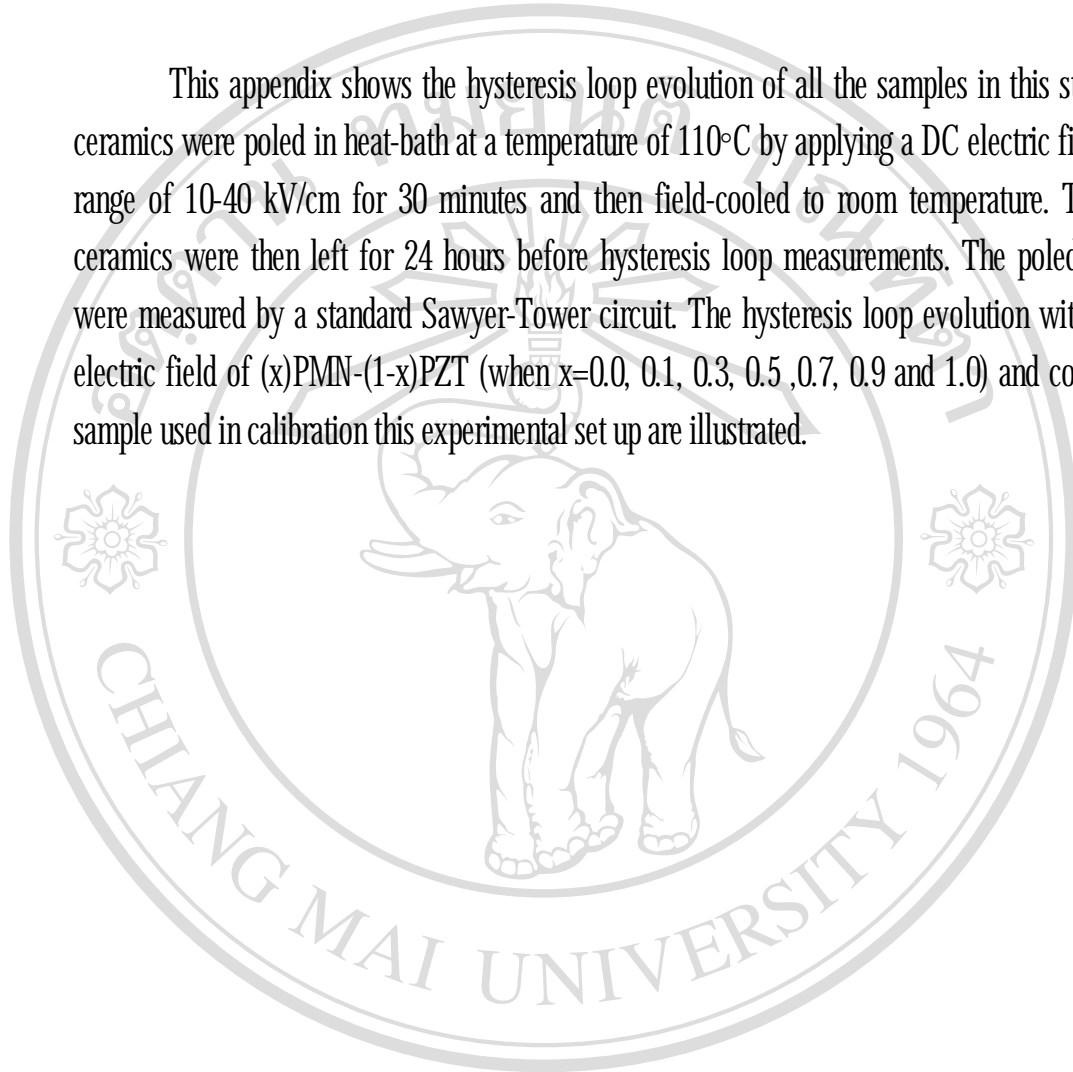


APPENDIX

HYSTERESIS LOOP EVOLUTION

This appendix shows the hysteresis loop evolution of all the samples in this study. The ceramics were poled in heat-bath at a temperature of 110°C by applying a DC electric field in the range of 10-40 kV/cm for 30 minutes and then field-cooled to room temperature. The poled ceramics were then left for 24 hours before hysteresis loop measurements. The poled samples were measured by a standard Sawyer-Tower circuit. The hysteresis loop evolution with applied electric field of (x)PMN-(1-x)PZT (when x=0.0, 0.1, 0.3, 0.5, 0.7, 0.9 and 1.0) and commercial sample used in calibration this experimental set up are illustrated.



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A.1. PKI-552 or soft PZT

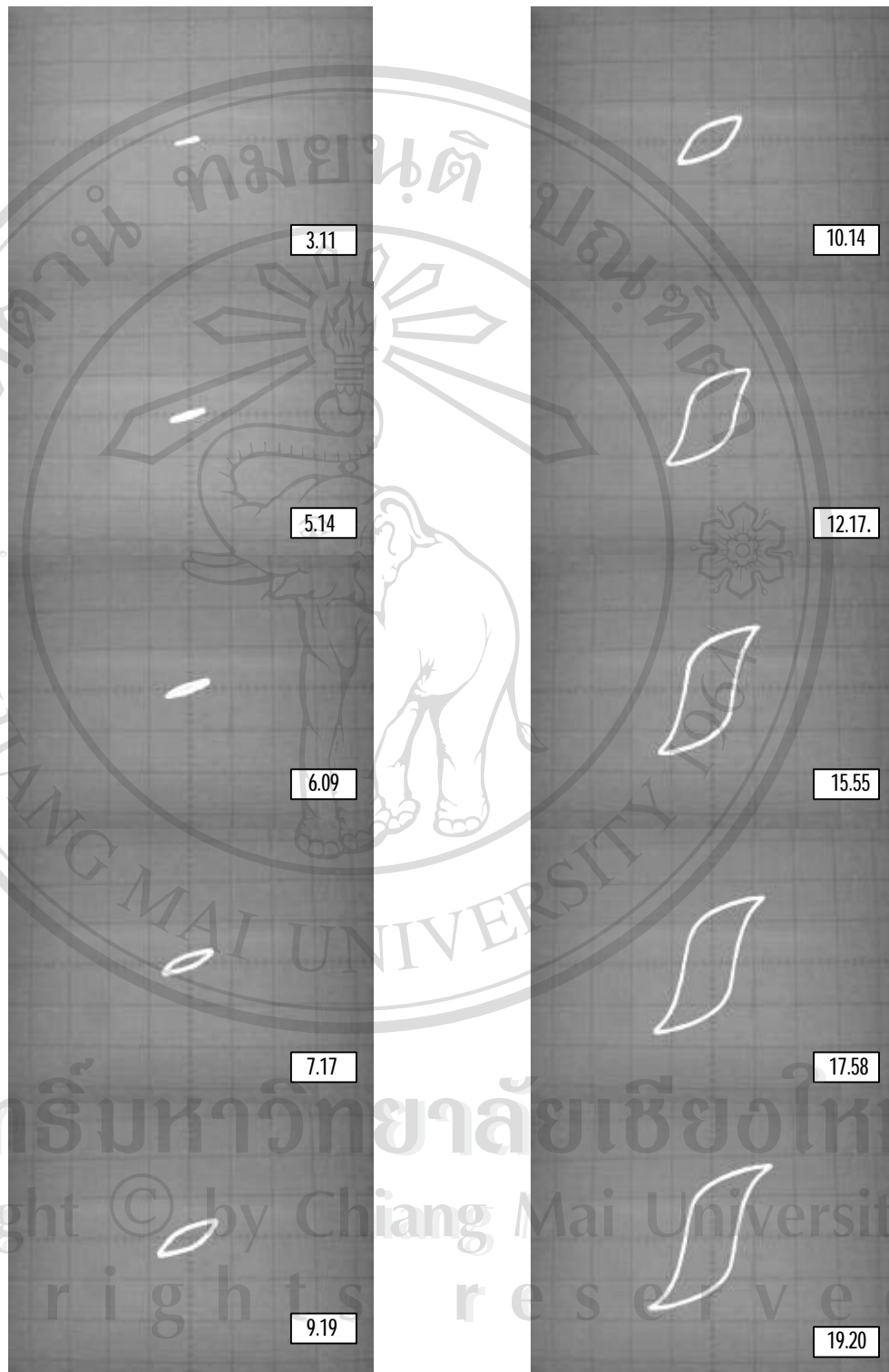


Figure A.1 Hysteresis loops evolution of commercial sample (PKI-552 or soft PZT) taken at AC drive amplitudes of: 3.11 to 19.20 kV/cm

A.2 PZT

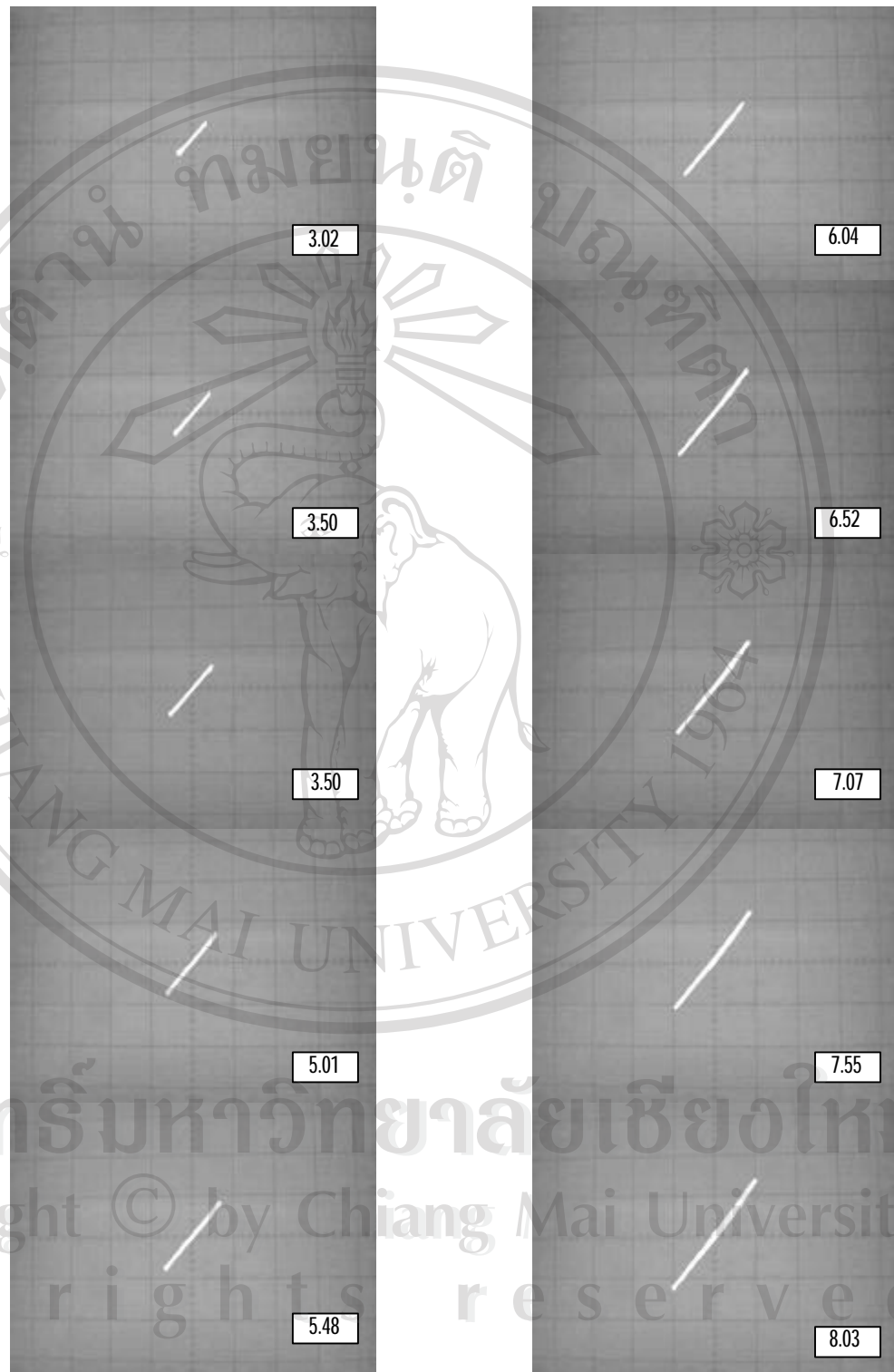


Figure A.2 Hysteresis loops evolution of PZT ceramics poled at 10 kV/cm taken at AC drive amplitudes of : 3.02 to 8.03 kV/cm

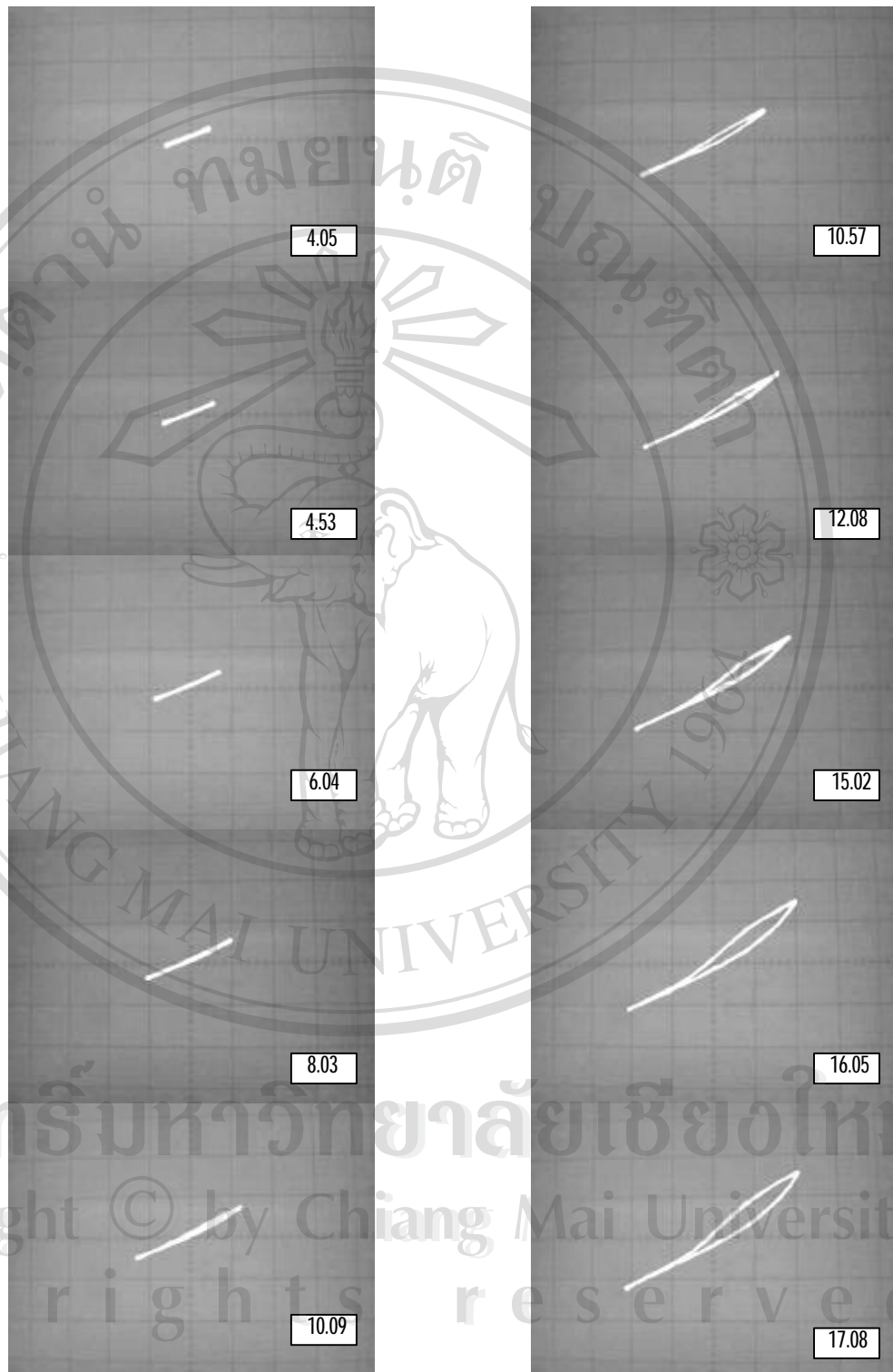


Figure A.3 Hysteresis loops evolution of PZT ceramics poled at 20 kV/cm taken at AC drive amplitudes of : 4.05 to 17.08 kV/cm

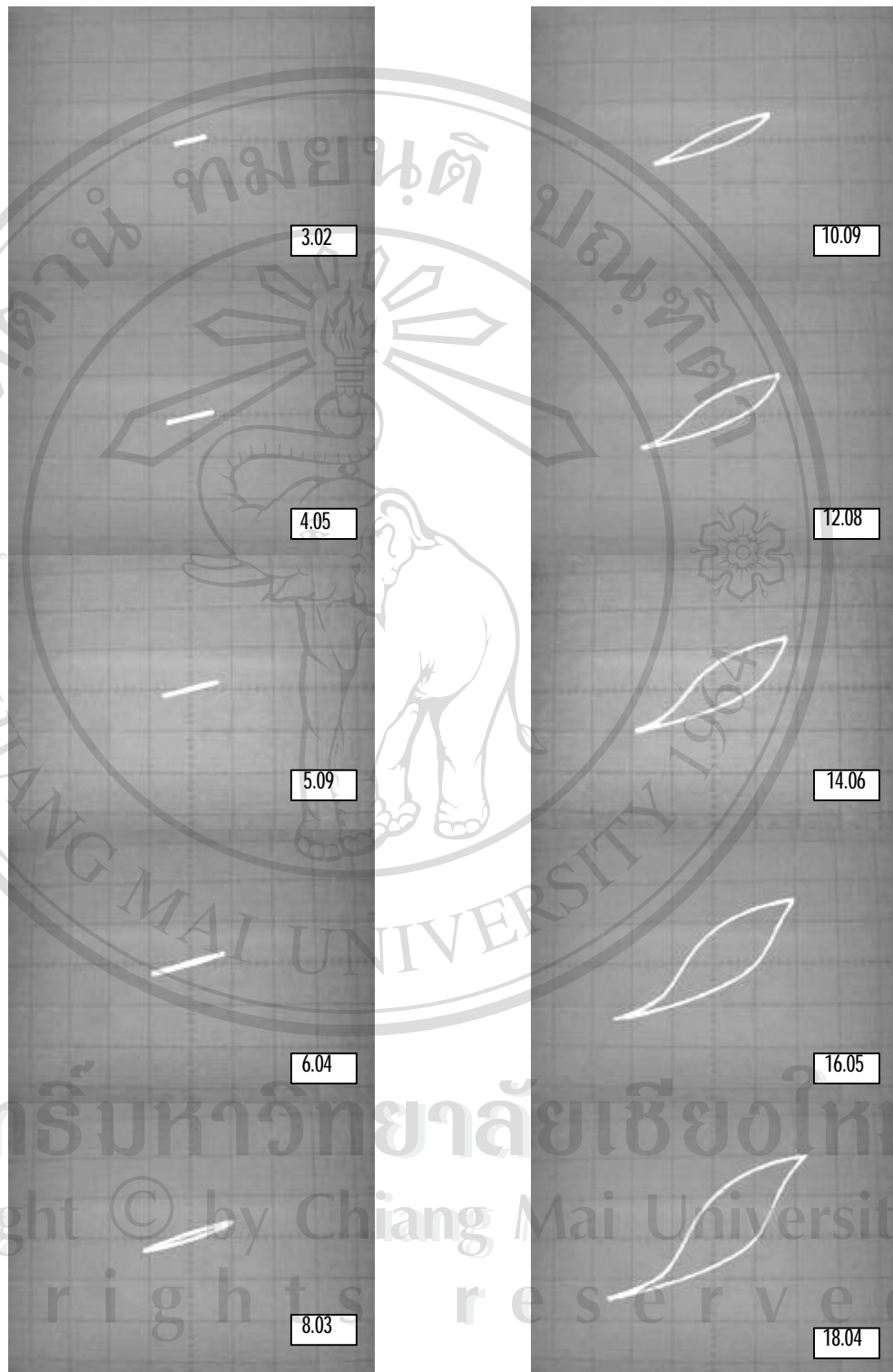


Figure A.4 Hysteresis loops evolution of PZT ceramics poled at 30 kV/cm taken at AC drive amplitudes of : 3.02 to 18.04 kV/cm

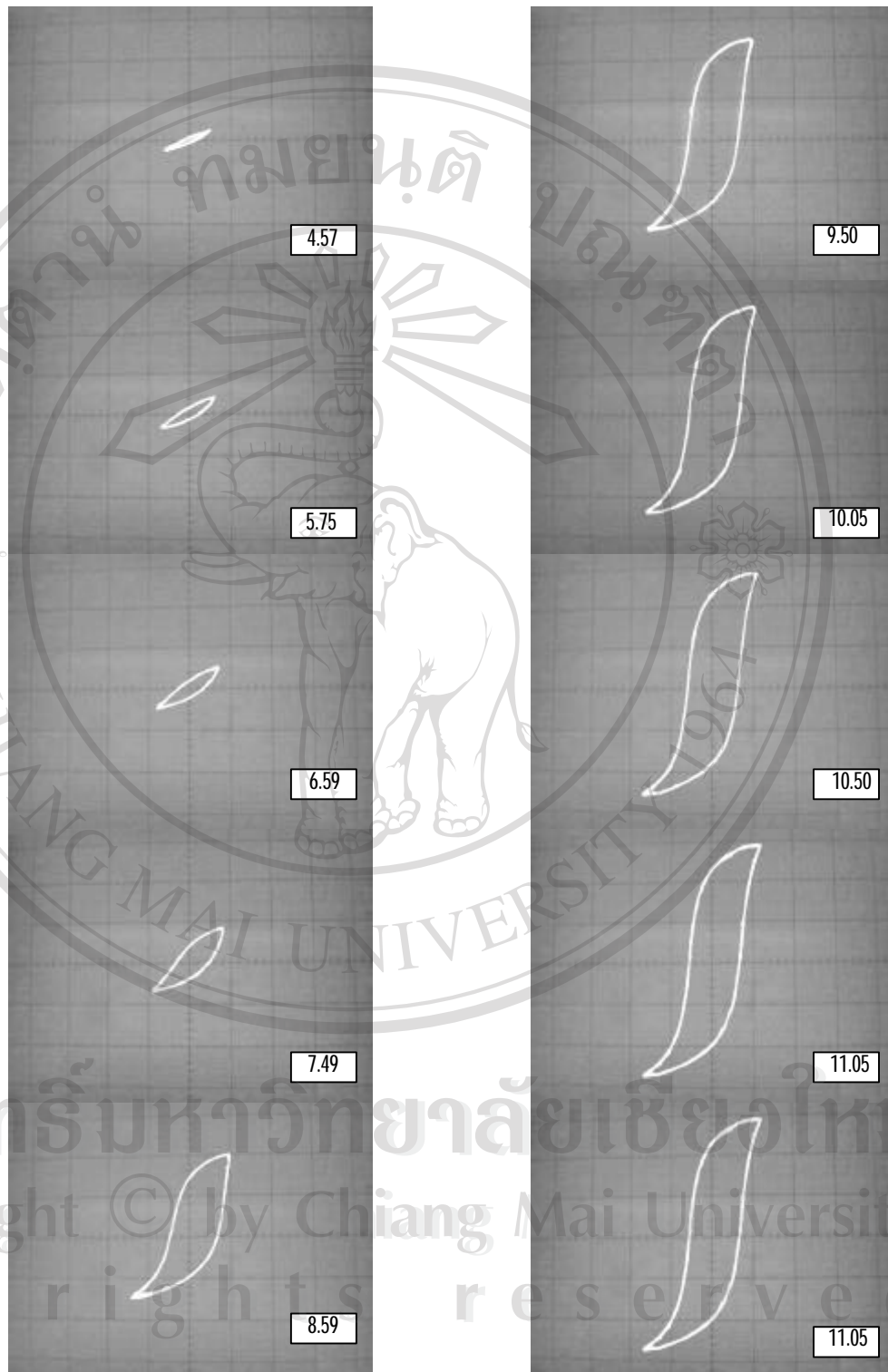
A.3 0.1PMN-0.9PZT

Figure A.5 Hysteresis loops evolution of 0.1PMN-0.9PZT ceramics poled at 10 kV/cm taken at AC drive amplitudes of : 4.57 to 11.05 kV/cm

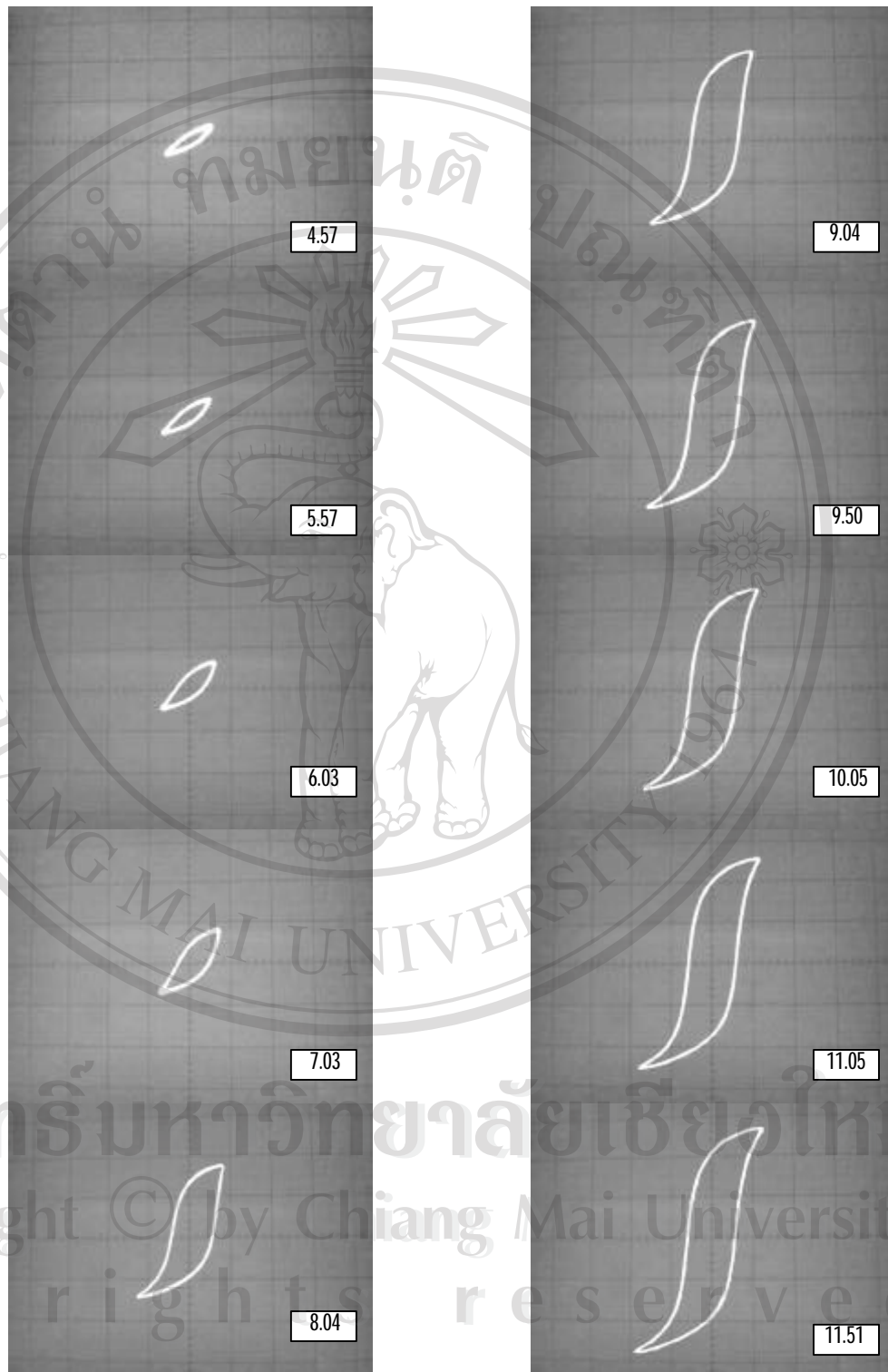


Figure A.6 Hysteresis loops evolution of 0.1PMN-0.9PZT ceramics poled at 20 kV/cm taken at AC drive amplitudes of : 4.57 to 11.51 kV/cm

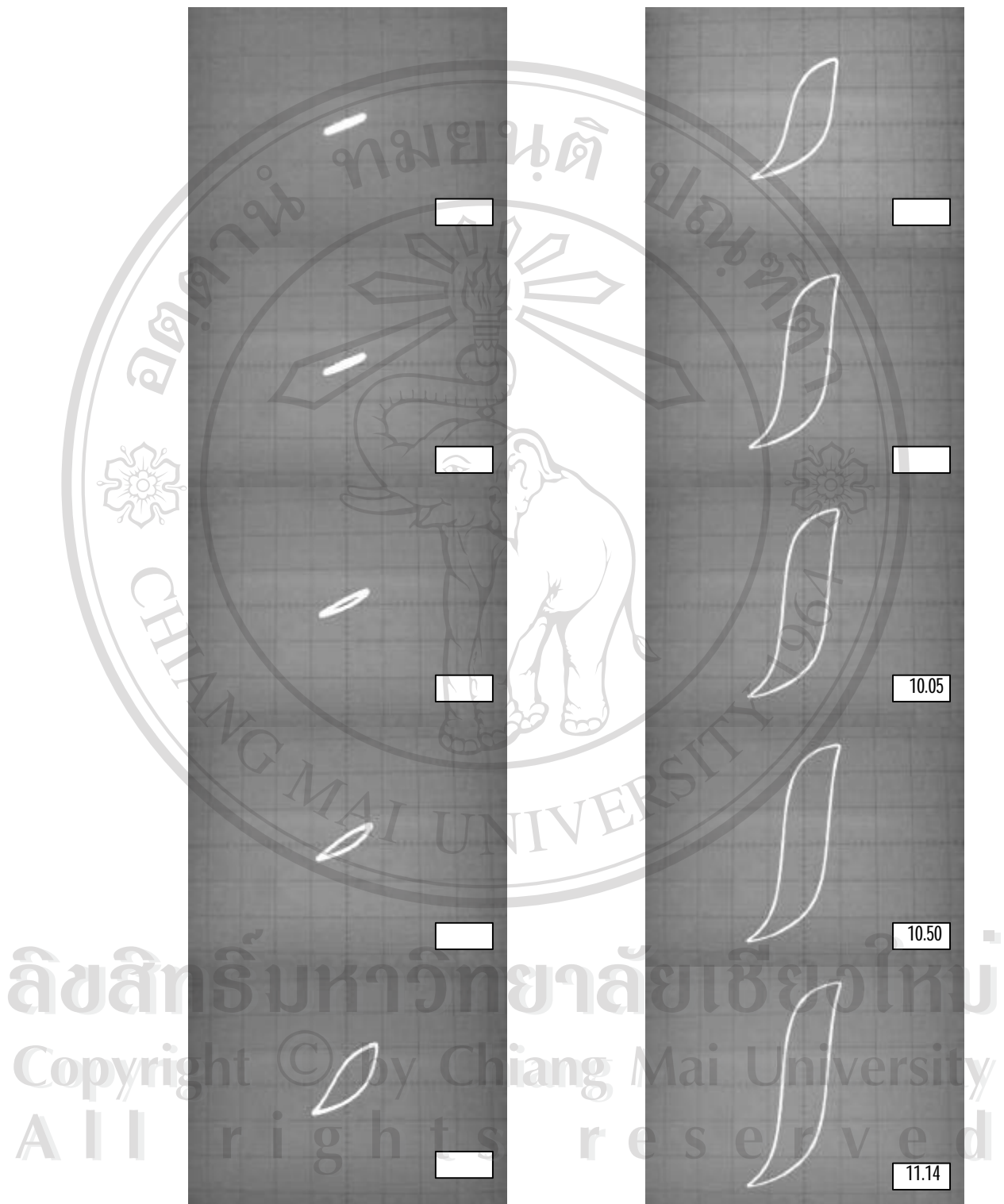


Figure A.7 Hysteresis loops evolution of 0.1PMN-0.9PZT ceramics poled at 30 kV/cm taken at AC drive amplitudes of : 3.03 to 11.14 kV/cm

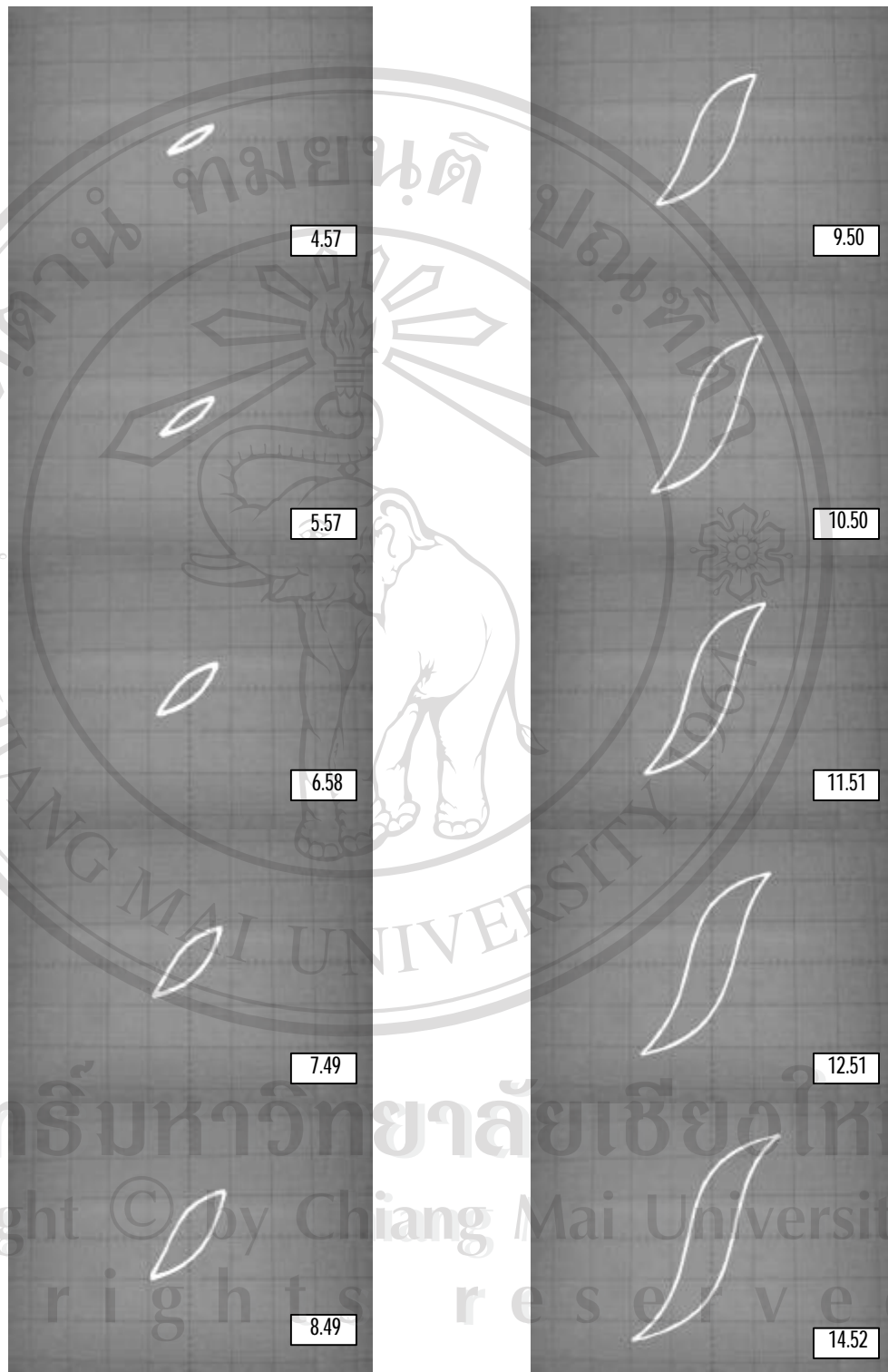


Figure A.8 Hysteresis loops evolution of 0.1PMN-0.9PZT ceramics poled at 40 kV/cm taken at AC drive amplitudes of : 4.57 to 14.52 kV/cm

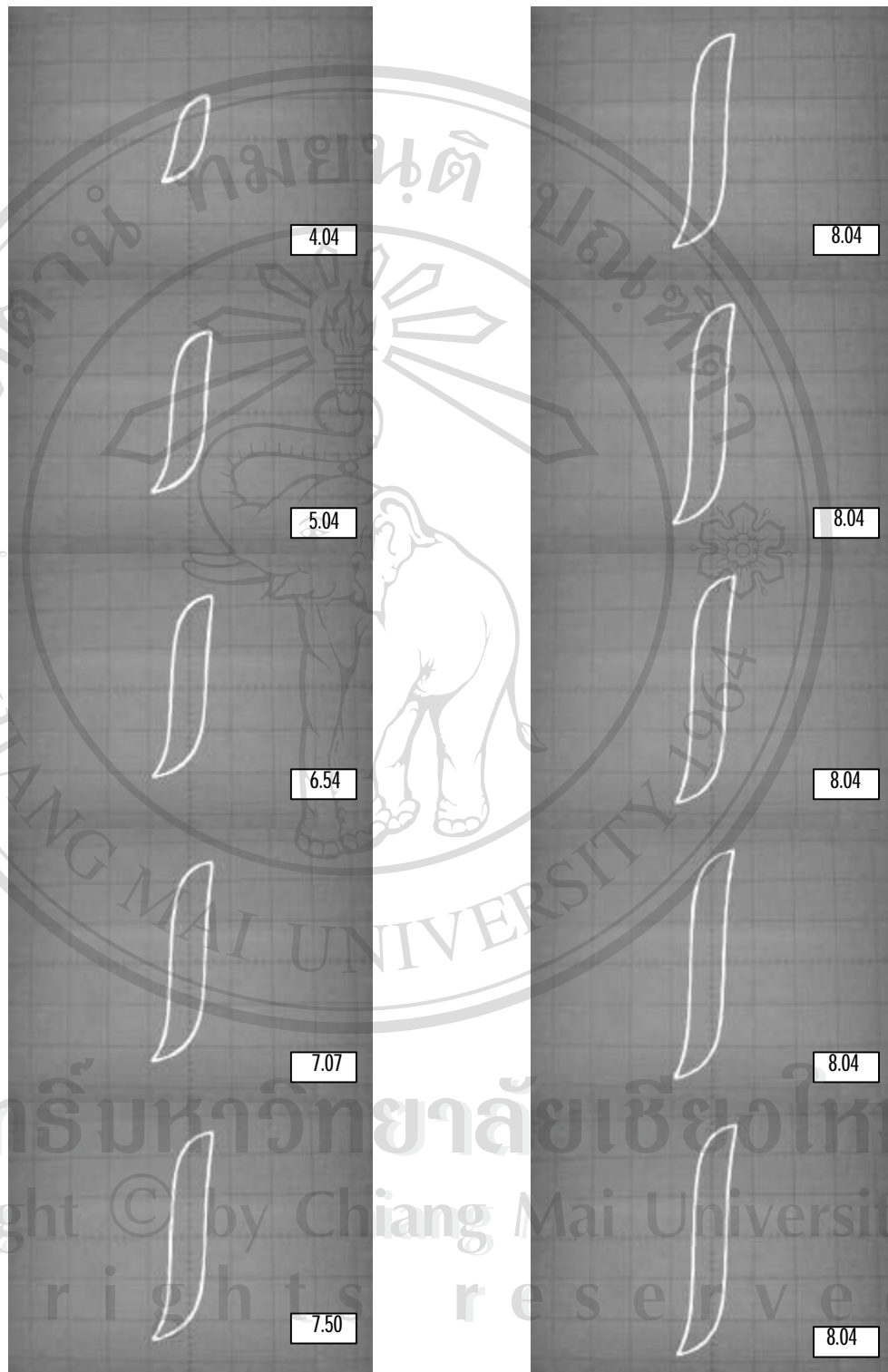
A.4 0.3PMN-0.7PZT

Figure A.9 Hysteresis loops evolution of 0.3PMN-0.7PZT ceramics poled at 10 kV/cm taken at AC drive amplitudes of : 4.04 to 8.04 kV/cm

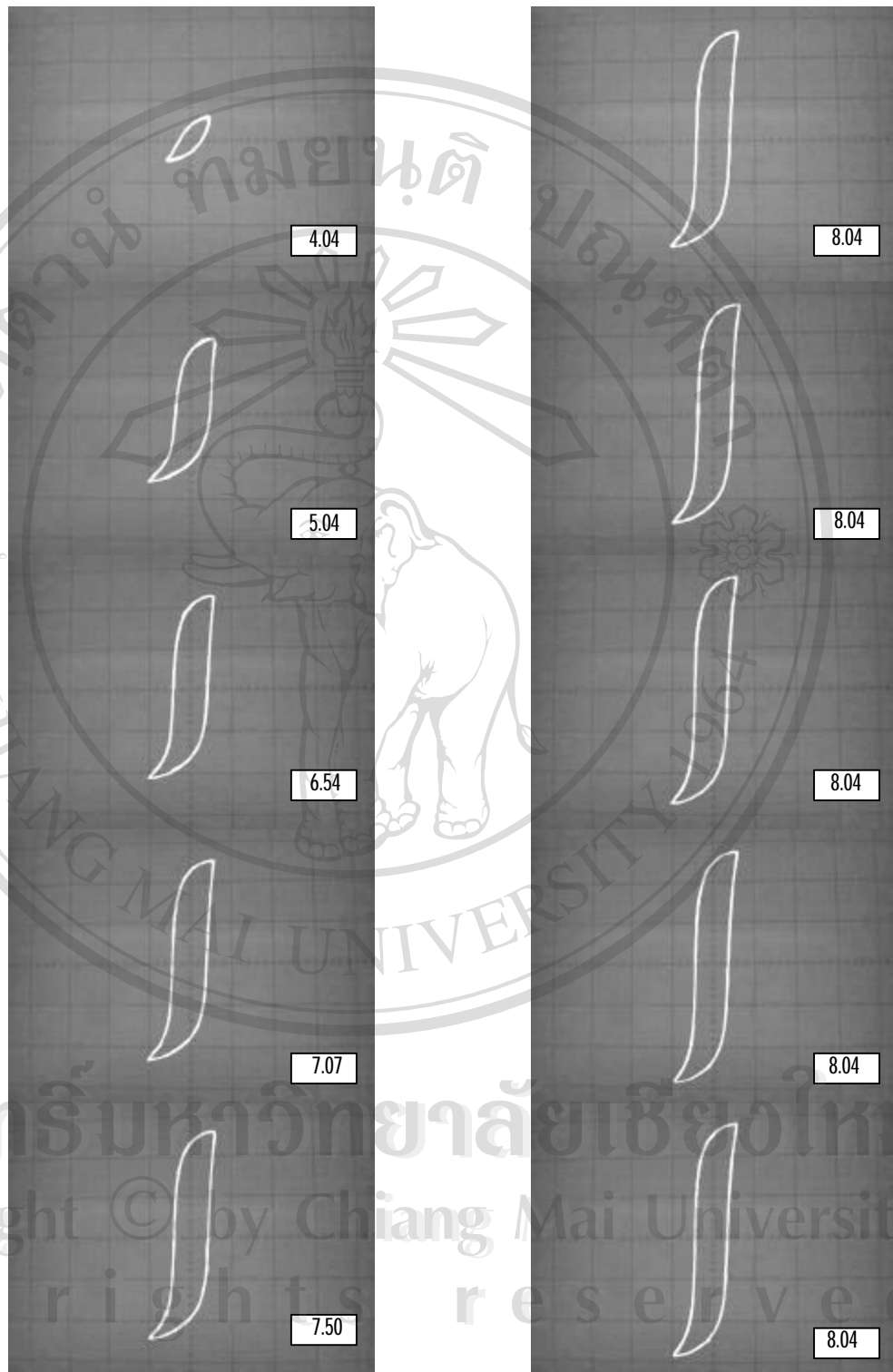


Figure A.10 Hysteresis loops evolution of 0.3PMN-0.7PZT ceramics poled at 20 kV/cm taken at AC drive amplitudes of : 4.04 to 8.04 kV/cm

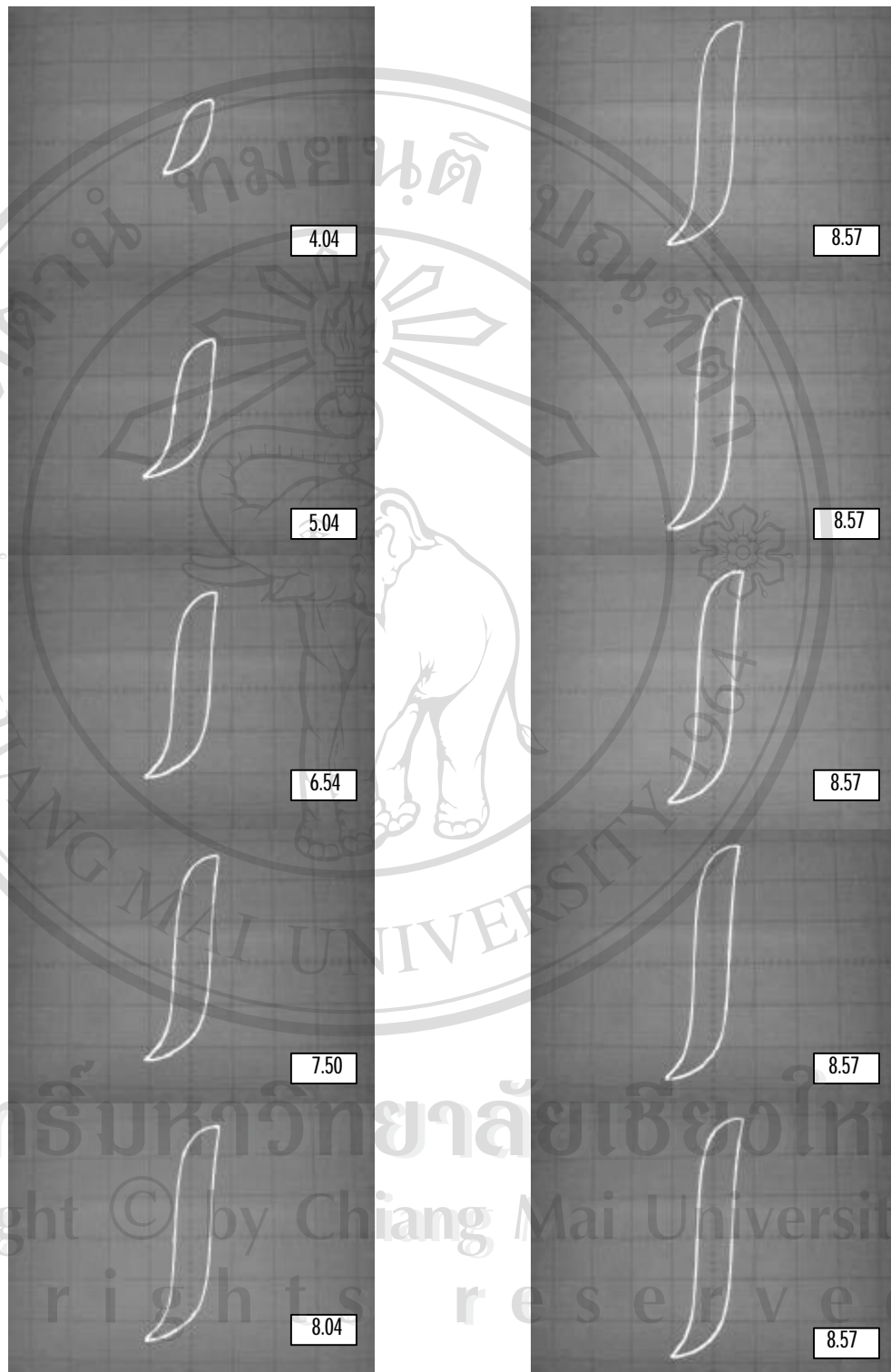


Figure A.11 Hysteresis loops evolution of 0.3PMN-0.7PZT ceramics poled at 30 kV/cm taken at AC drive amplitudes of : 4.04 to 8.57 kV/cm

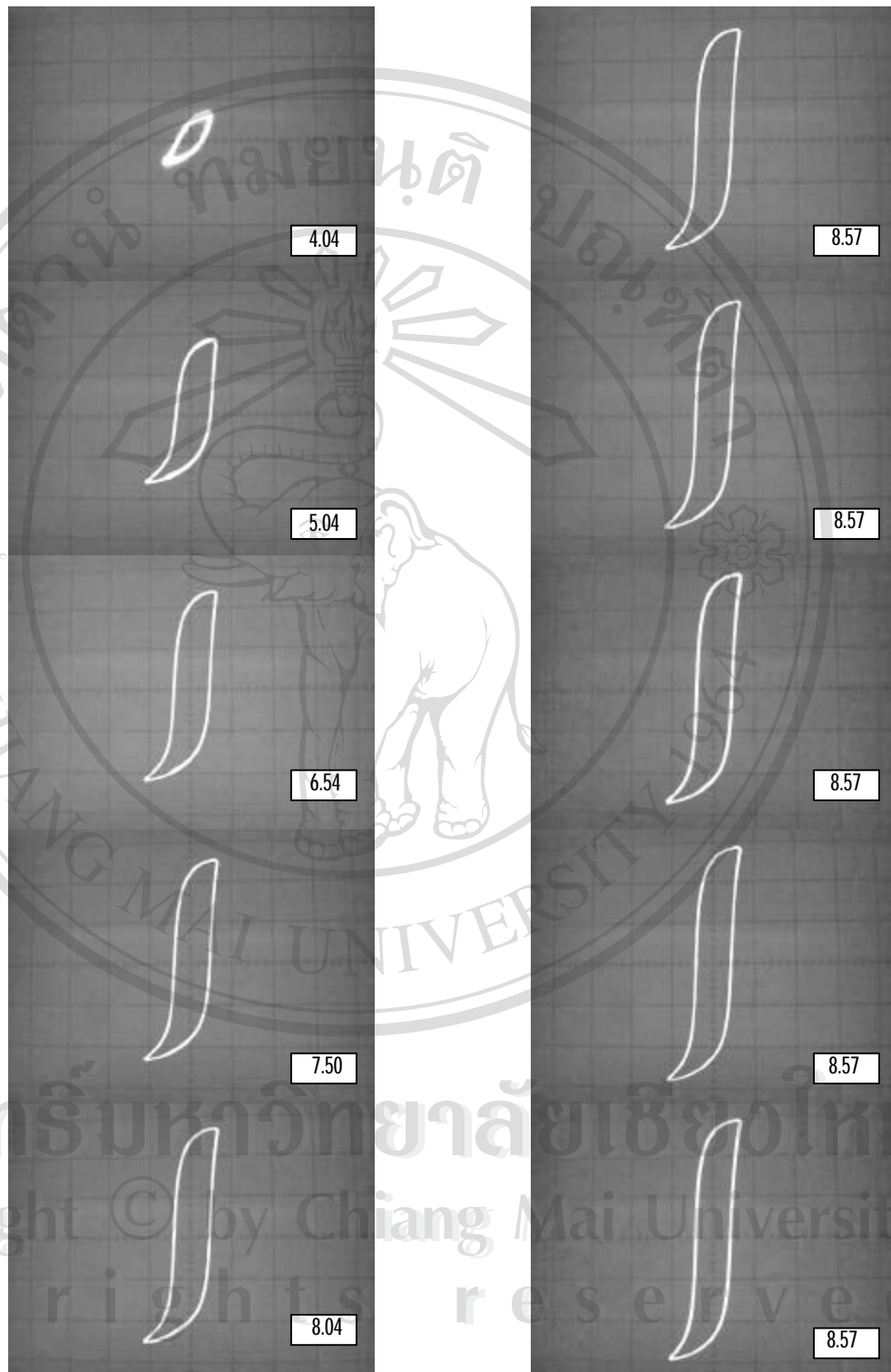


Figure A.12 Hysteresis loops evolution of 0.3PMN-0.7PZT ceramics poled at 40 kV/cm taken at AC drive amplitudes of : 4.04 to 8.57 kV/cm

A.5 0.5PMN-0.5PZT

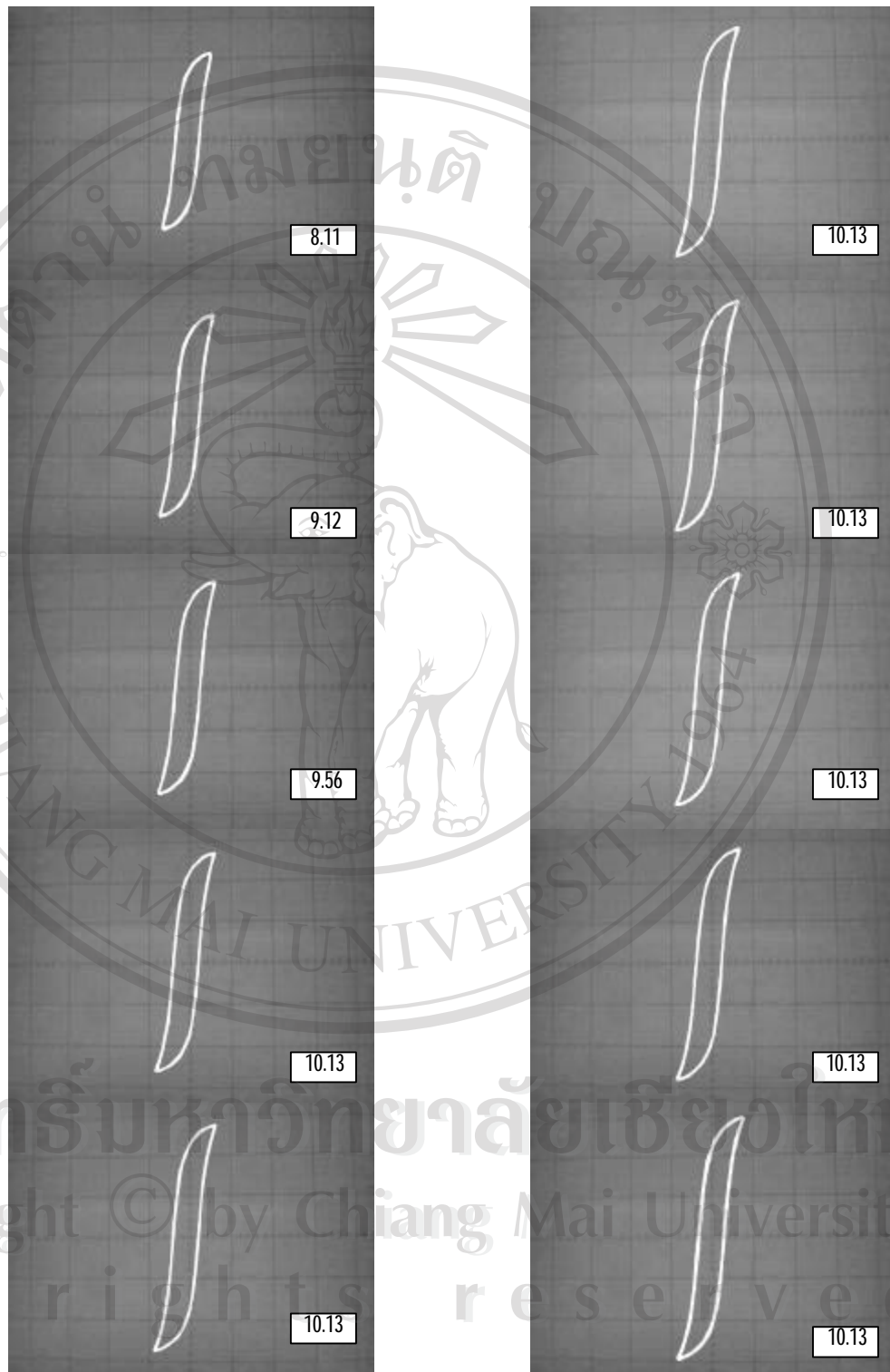


Figure A.13 Hysteresis loops evolution of 0.5PMN-0.5PZT ceramics poled at 10 kV/cm taken at AC drive amplitudes of : 8.11 to 10.13 kV/cm

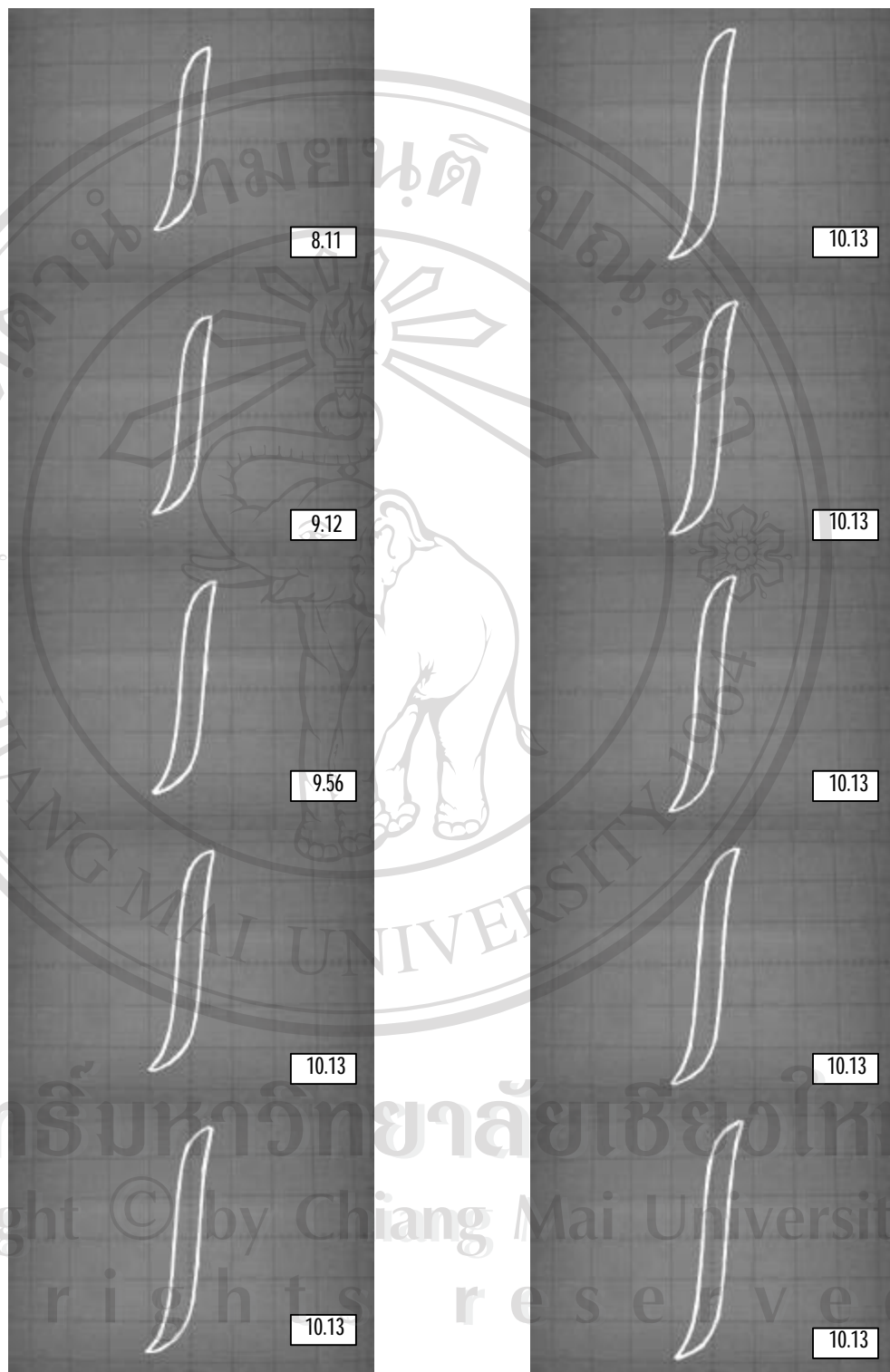


Figure A.14 Hysteresis loops evolution of 0.5PMN-0.5PZT ceramics poled at 20 kV/cm taken at AC drive amplitudes of : 8.11 to 10.13 kV/cm

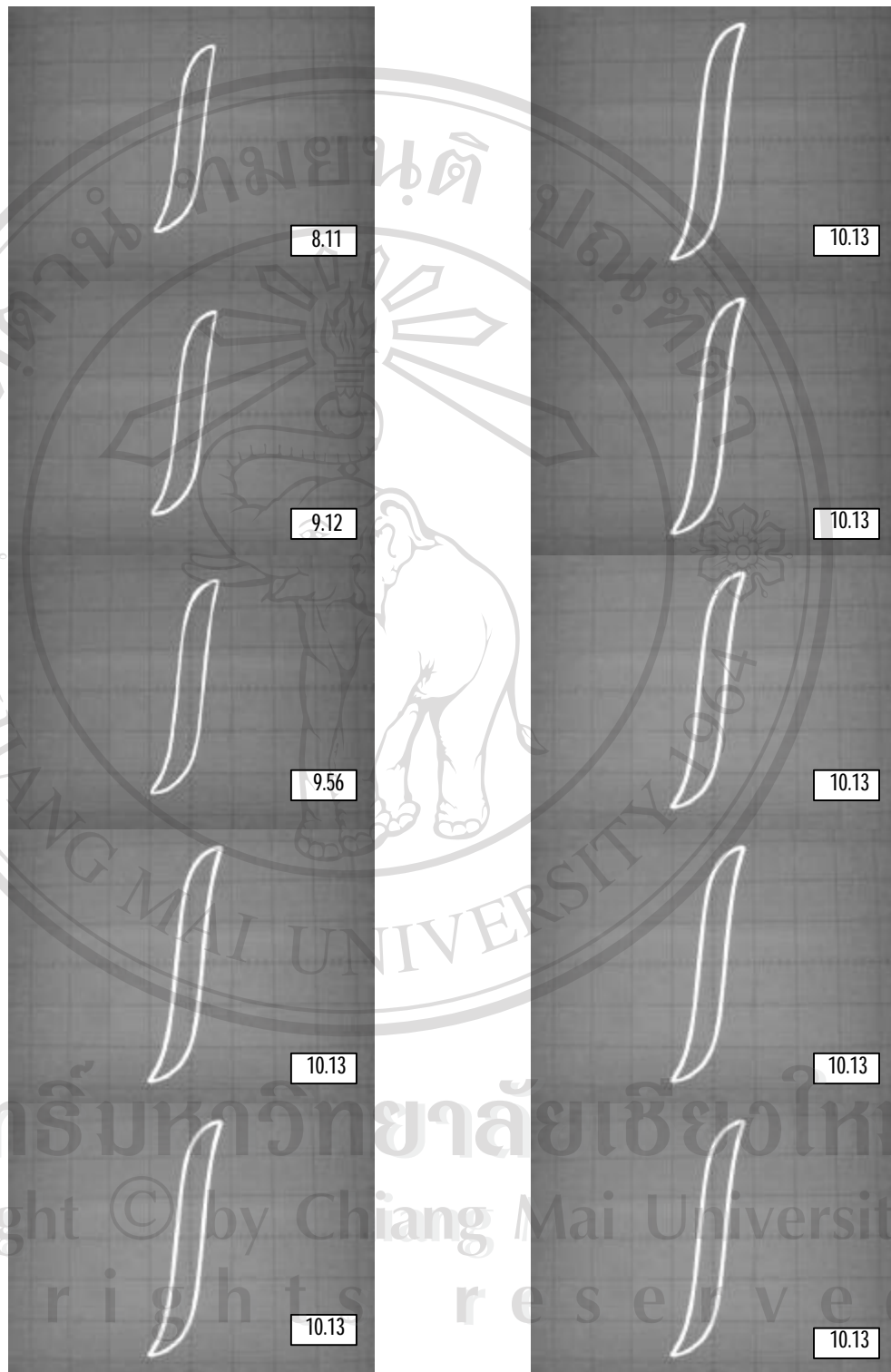


Figure A.15 Hysteresis loops evolution of 0.5PMN-0.5PZT ceramics poled at 30 kV/cm taken at AC drive amplitudes of : 8.11 to 10.13 kV/cm

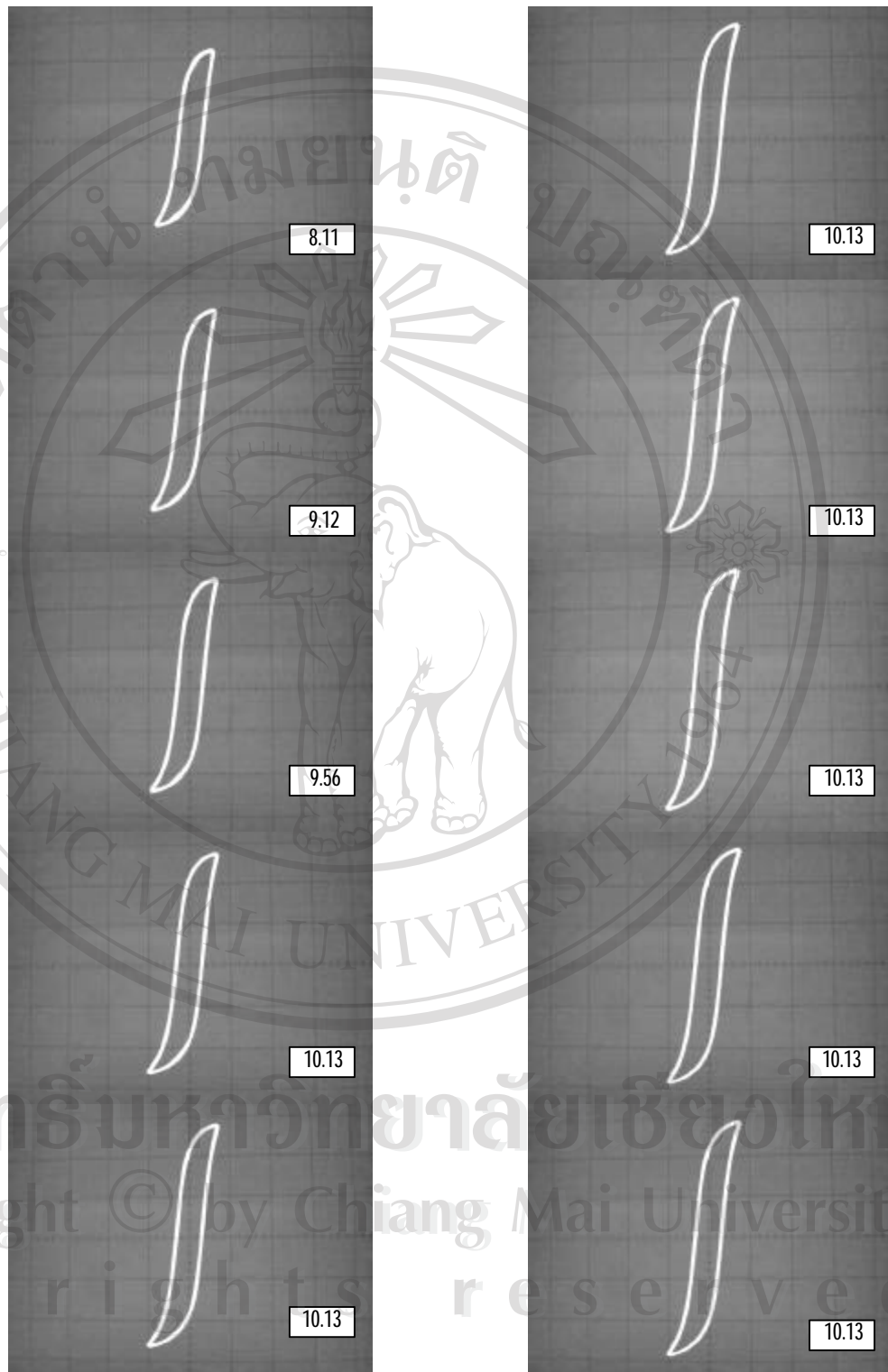


Figure A.16 Hysteresis loops evolution of 0.5PMN-0.5PZT ceramics poled at 40 kV/cm taken at AC drive amplitudes of : 8.11 to 10.13 kV/cm

A.6 0.7PMN-0.3PZT

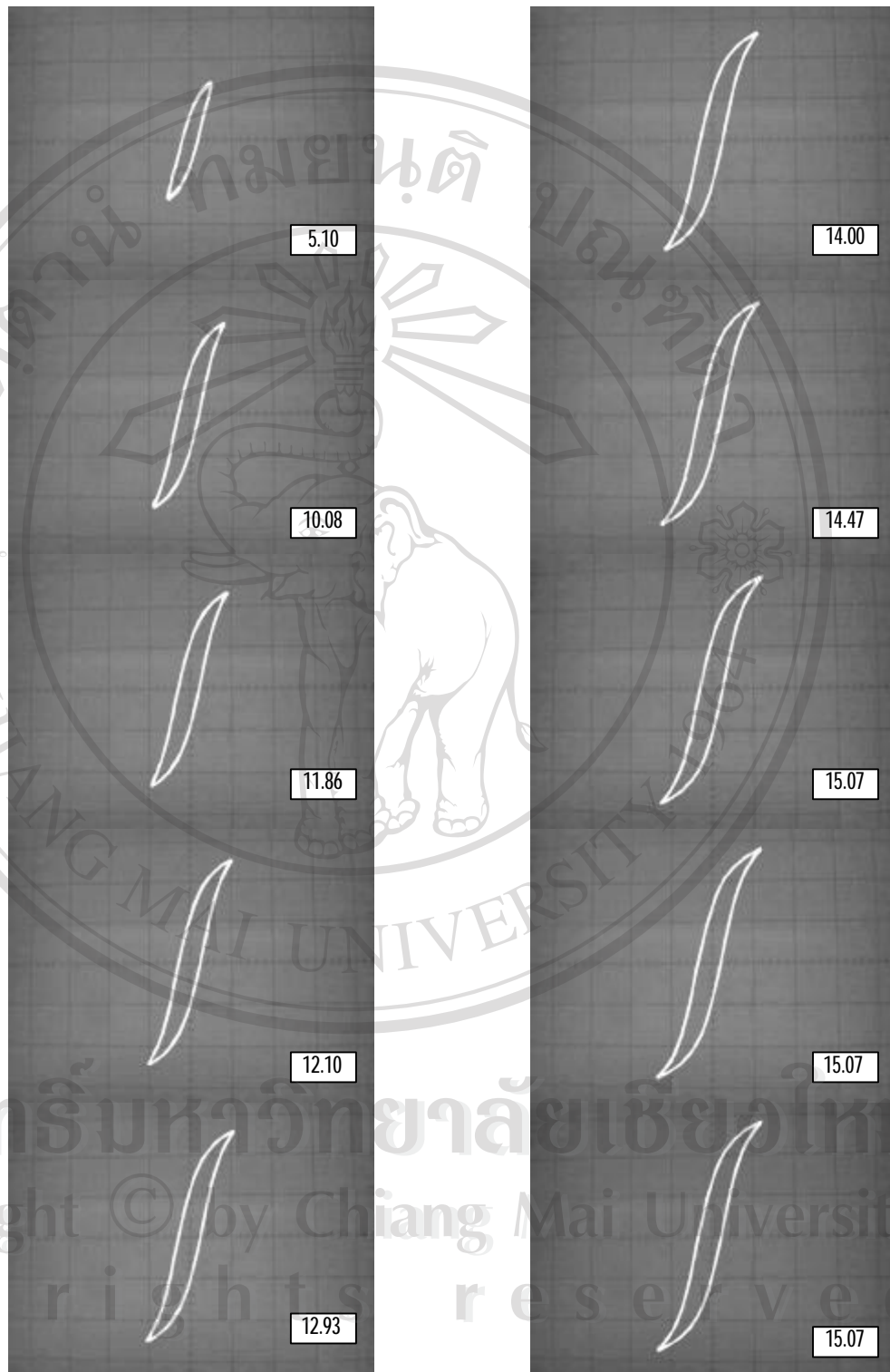


Figure A.17 Hysteresis loops evolution of 0.7PMN-0.3PZT ceramics poled at 10 kV/cm taken at AC drive amplitudes of : 5.10 to 15.07 kV/cm

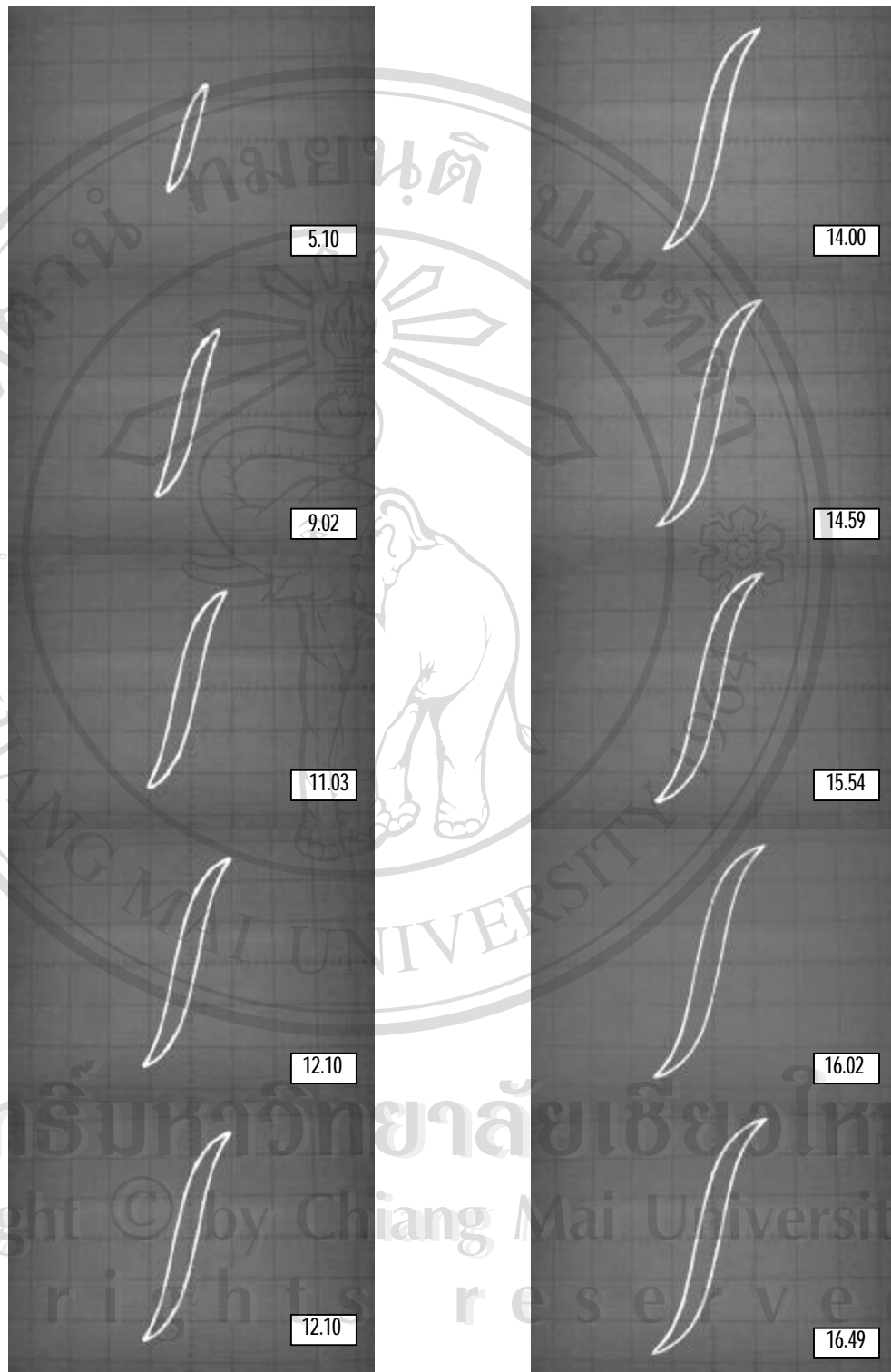


Figure A.18 Hysteresis loops evolution of 0.7PMN-0.3PZT ceramics poled at 20 kV/cm taken at AC drive amplitudes of : 5.10 to 16.49 kV/cm

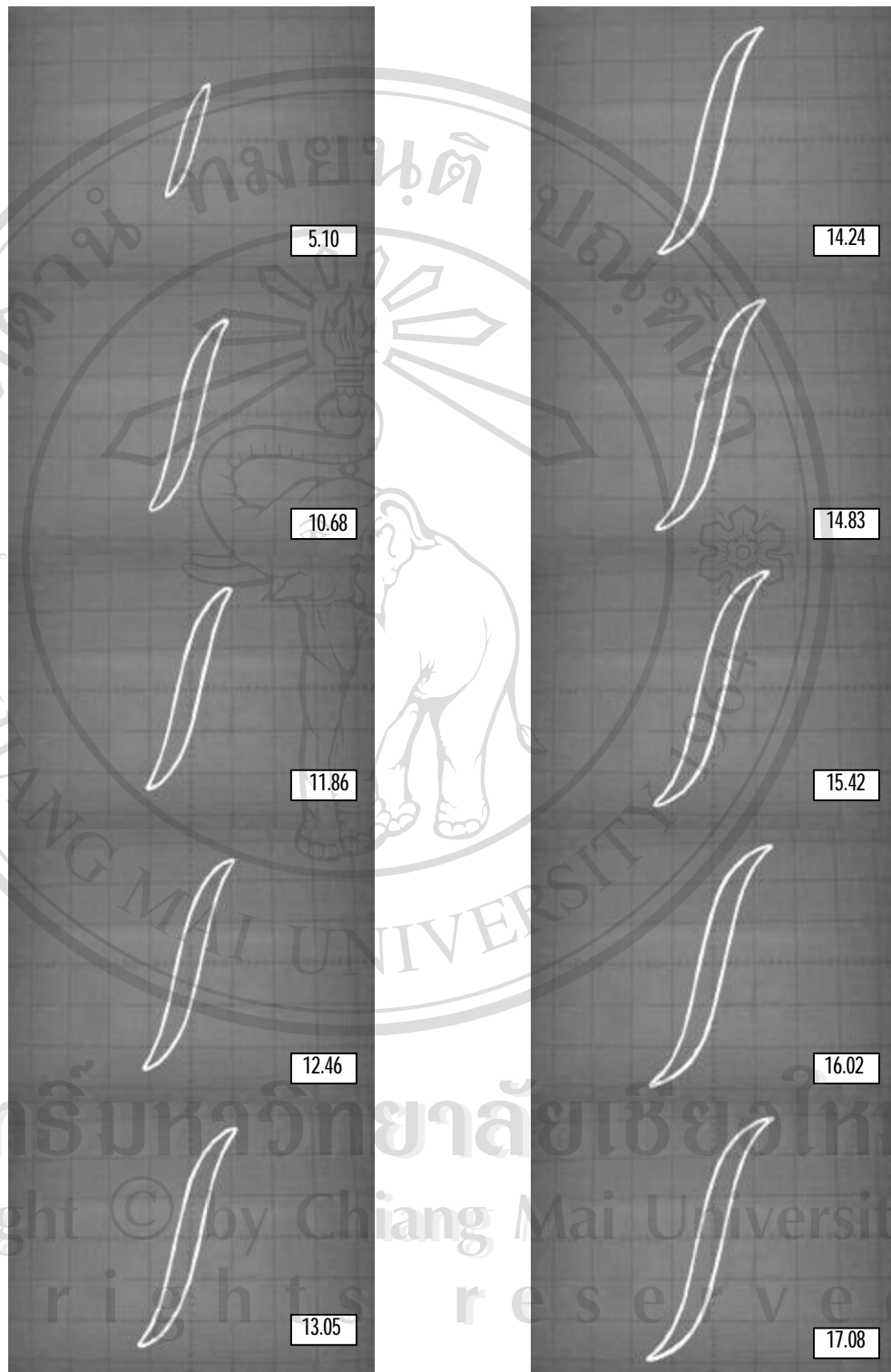


Figure A.19 Hysteresis loops evolution of 0.7PMN-0.3PZT ceramics poled at 30 kV/cm taken at AC drive amplitudes of : 5.10 to 17.08 kV/cm

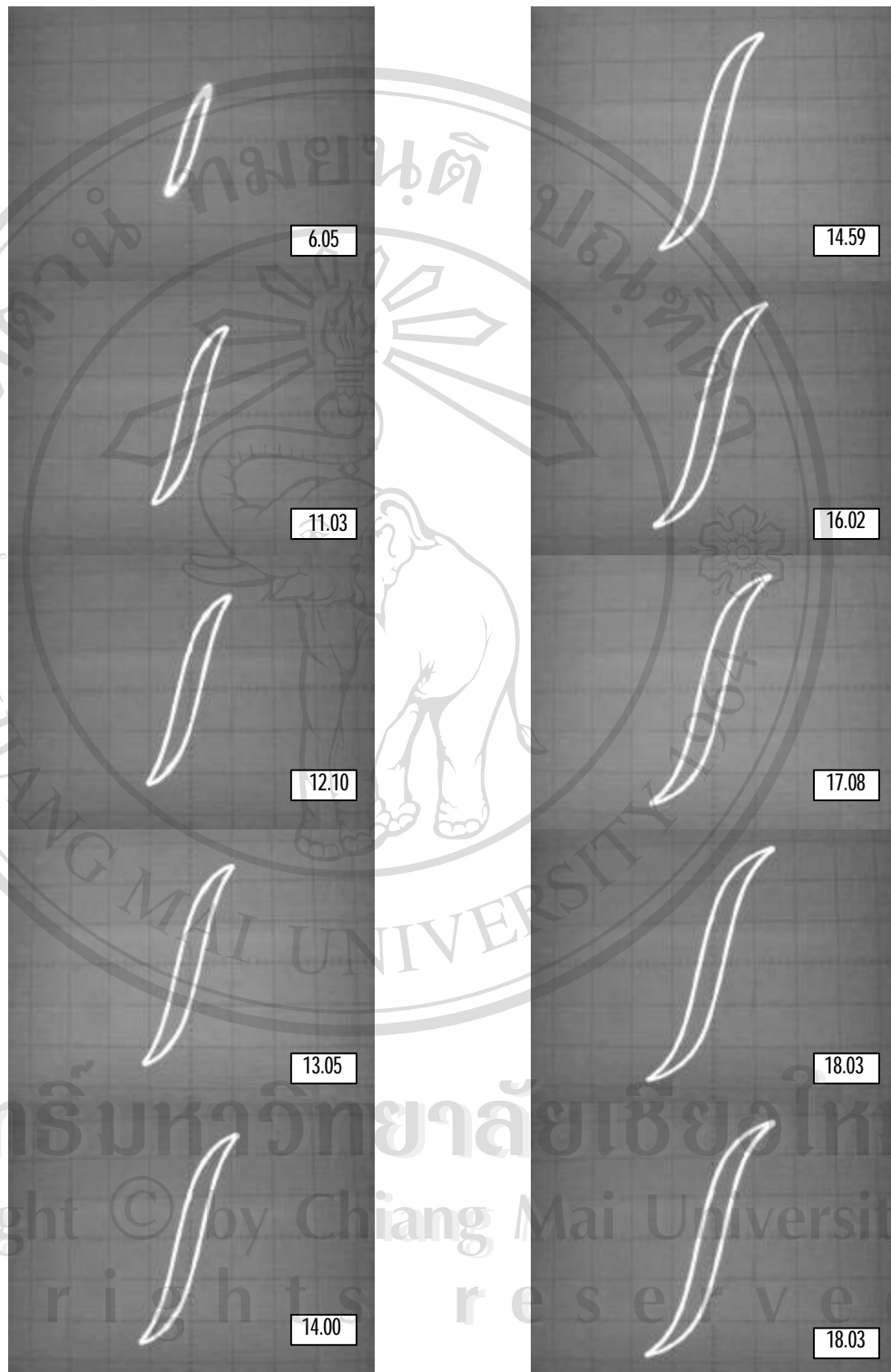


Figure A.20 Hysteresis loops evolution of 0.7PMN-0.3PZT ceramics poled at 40 kV/cm taken at AC drive amplitudes of : 6.05 to 18.03 kV/cm

A.7. 0.9PMN-0.1PZT

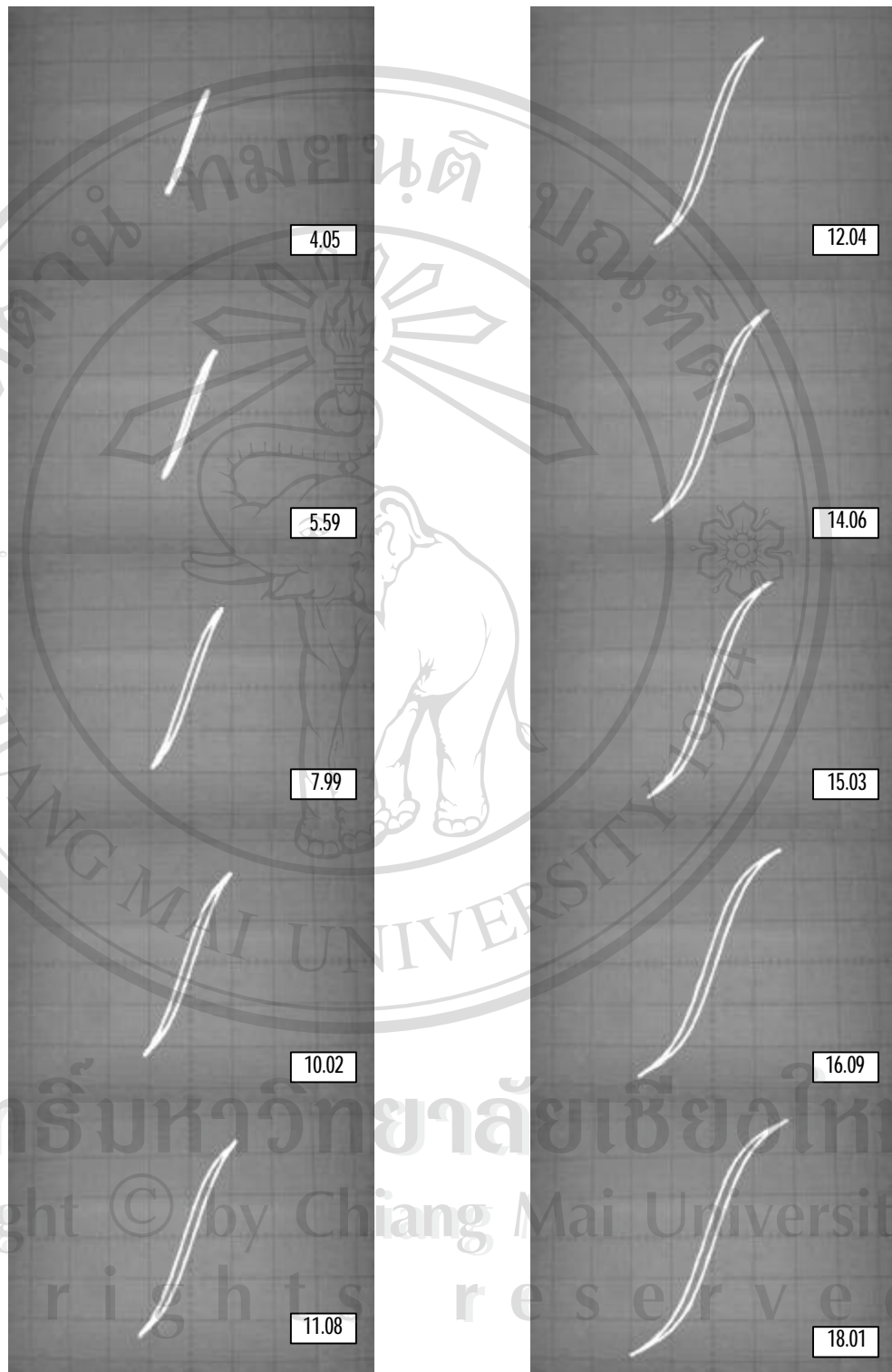


Figure A.21 Hysteresis loops evolution of 0.9PMN-0.1PZT ceramics poled at 10 kV/cm taken at AC drive amplitudes of : 4.05 to 18.01 kV/cm

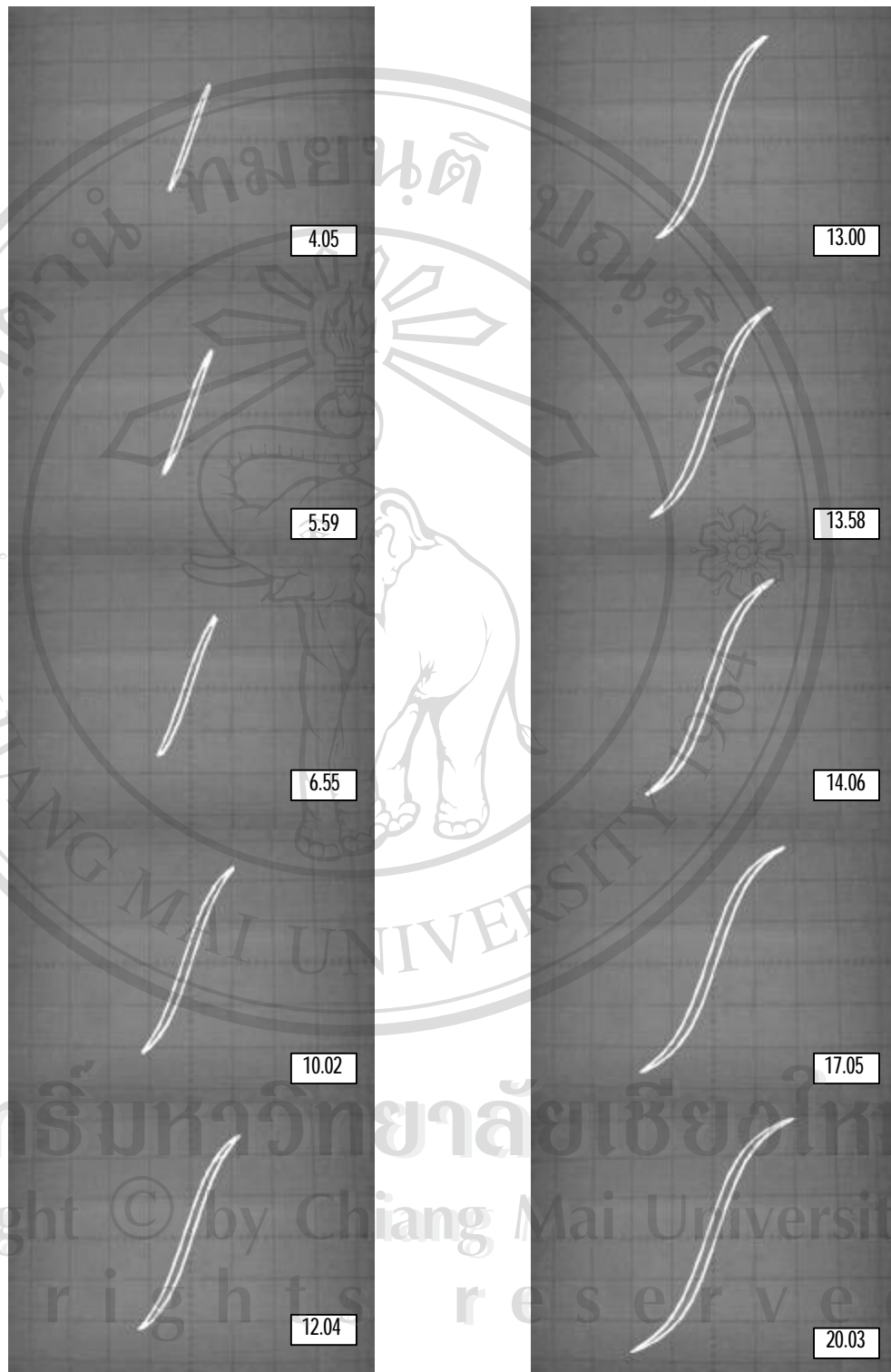


Figure A.22 Hysteresis loops evolution of 0.9PMN-0.1PZT ceramics poled at 20 kV/cm taken at AC drive amplitudes of : 4.05 to 20.03 kV/cm

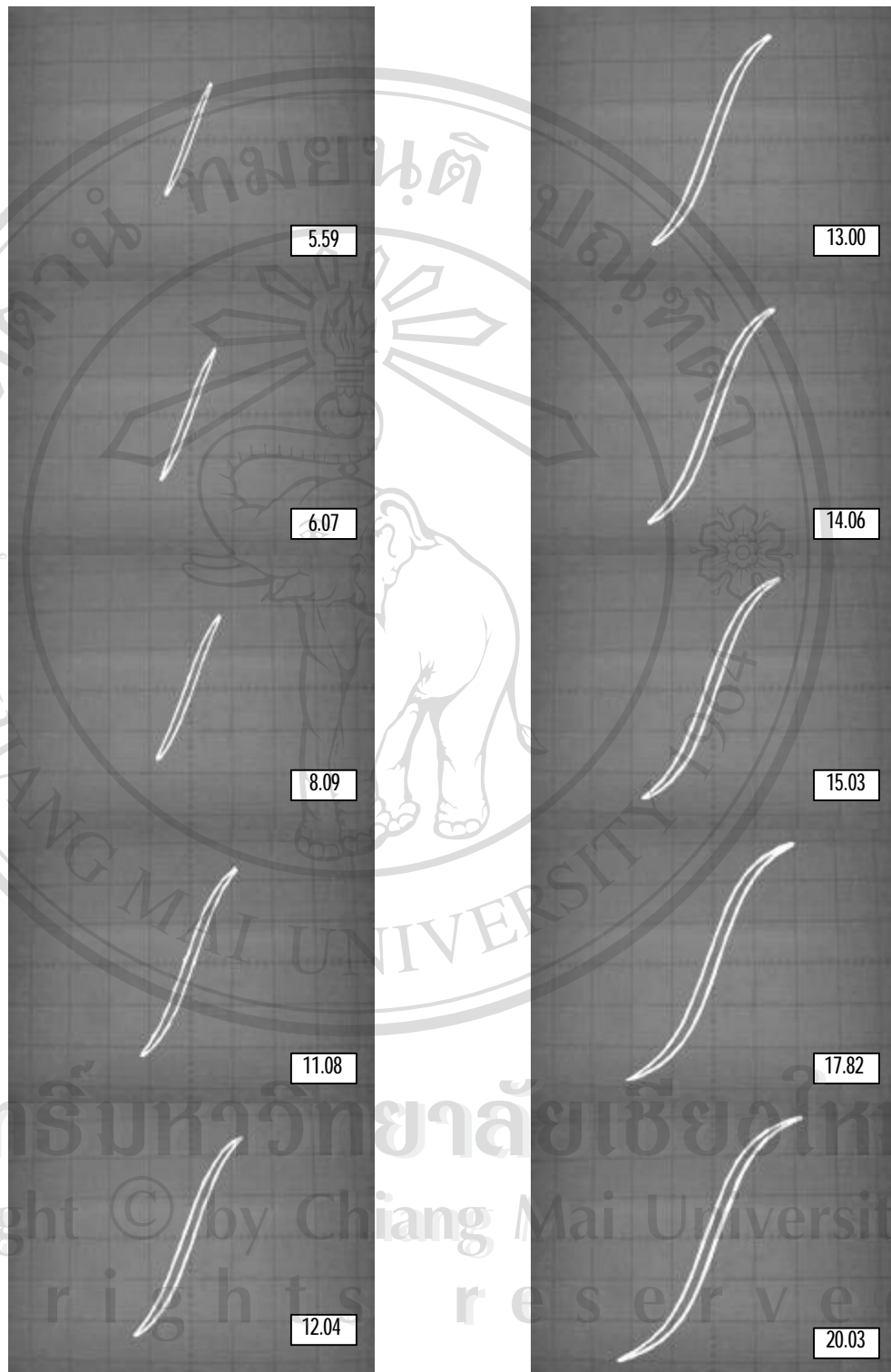


Figure A.23 Hysteresis loops evolution of 0.9PMN-0.1PZT ceramics poled at 30 kV/cm taken at AC drive amplitudes of : 5.59 to 20.03 kV/cm

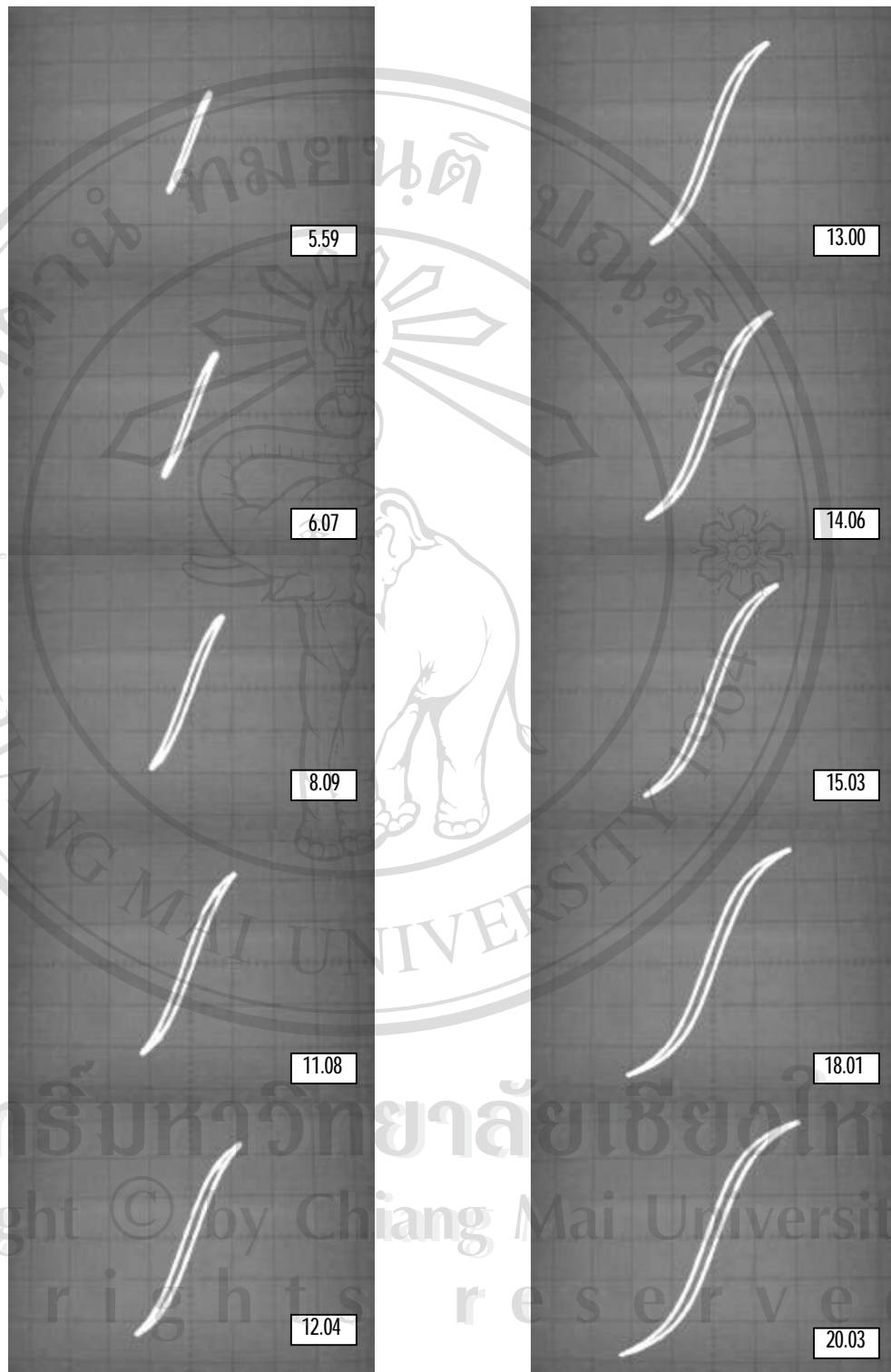


Figure A.24 Hysteresis loops evolution of 0.9PMN-0.1PZT ceramics poled at 40 kV/cm taken at AC drive amplitudes of : 5.59 to 20.03 kV/cm

A.8 PMN

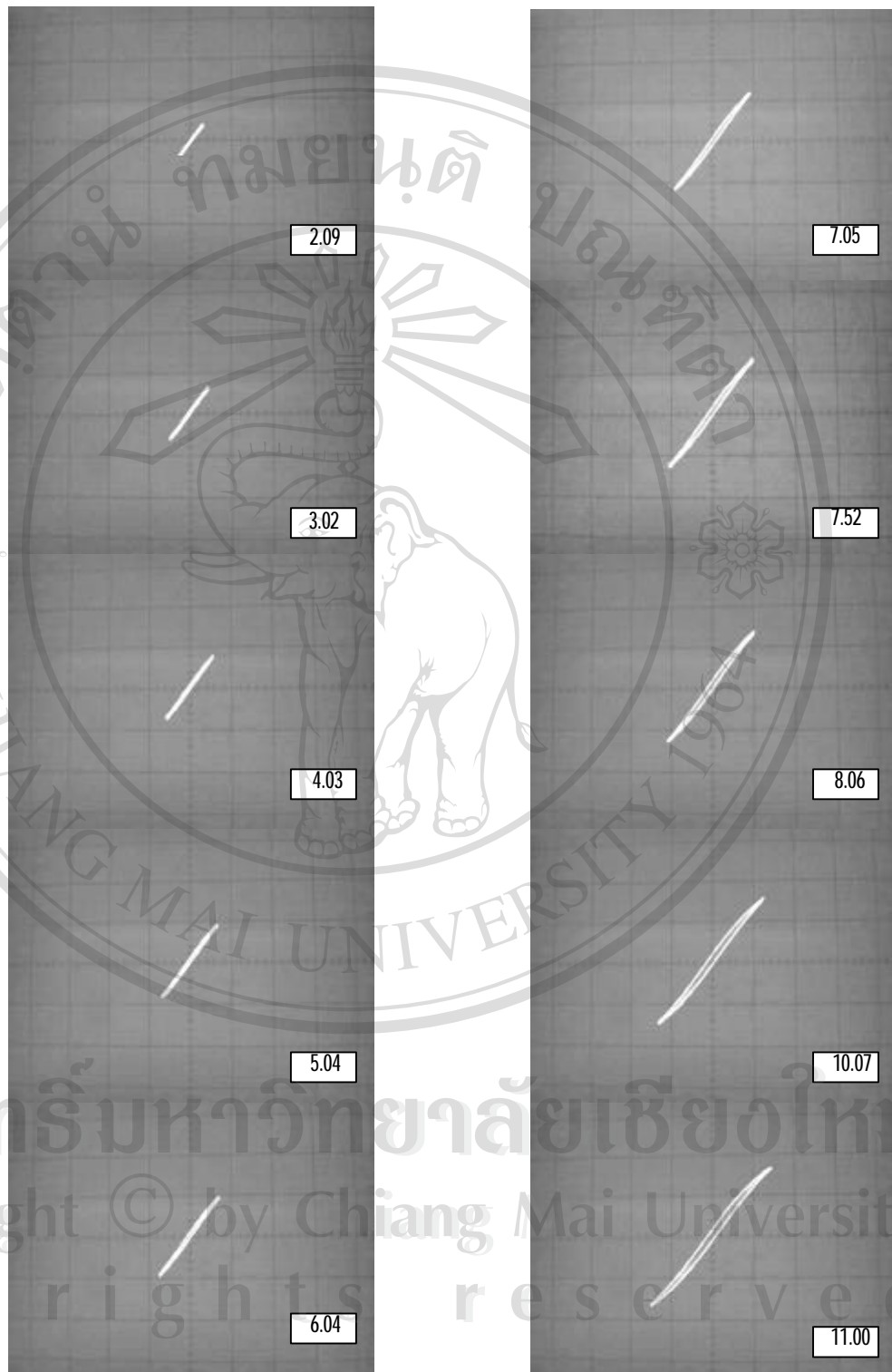


Figure A.25 Hysteresis loops evolution of PMN ceramics poled at 10 kV/cm taken at AC drive amplitudes of : 2.09 to 11.00 kV/cm

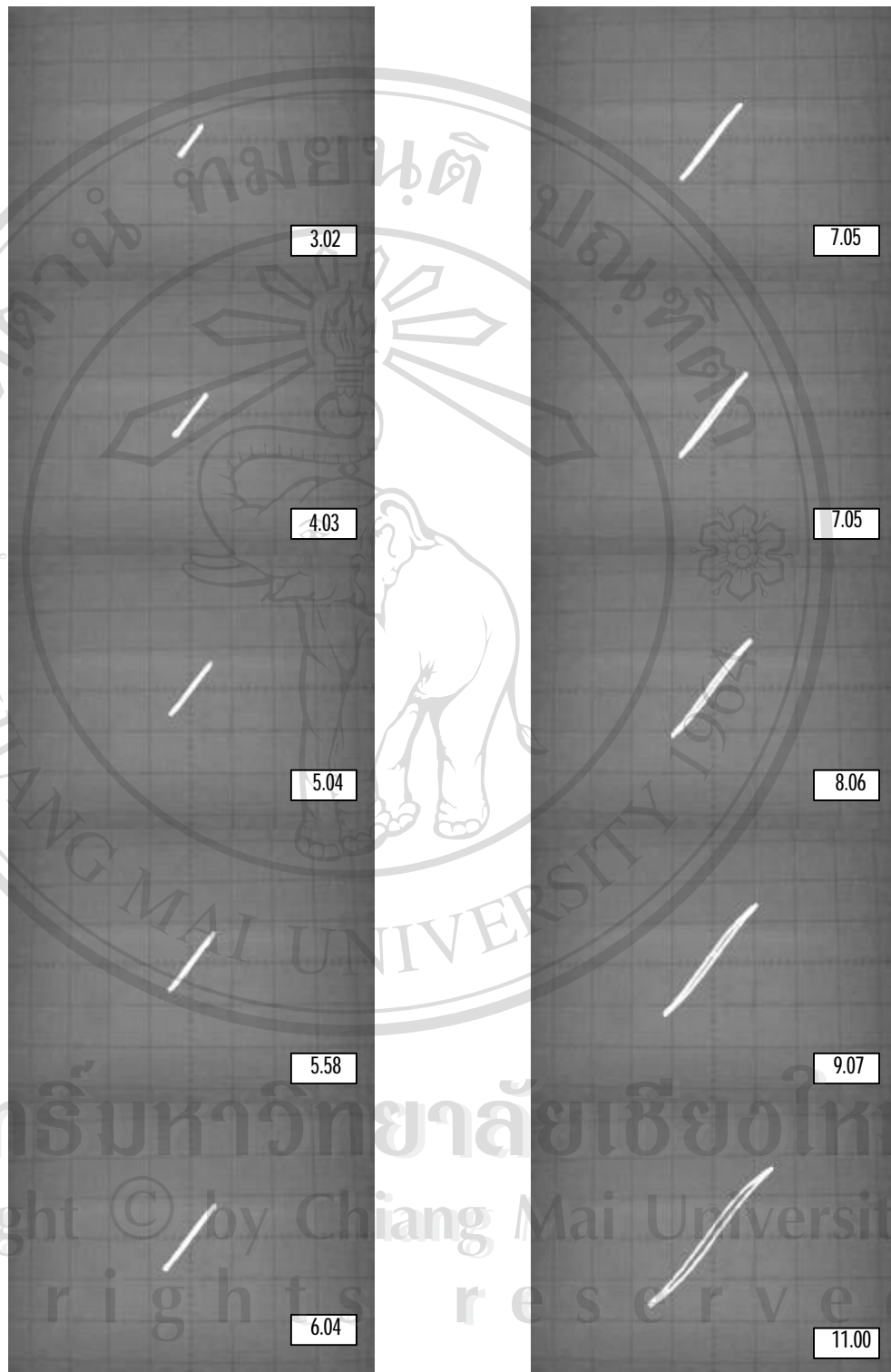


Figure A.26 Hysteresis loops evolution of PMN ceramics poled at 20 kV/cm taken at AC drive amplitudes of : 3.02 to 11.00 kV/cm

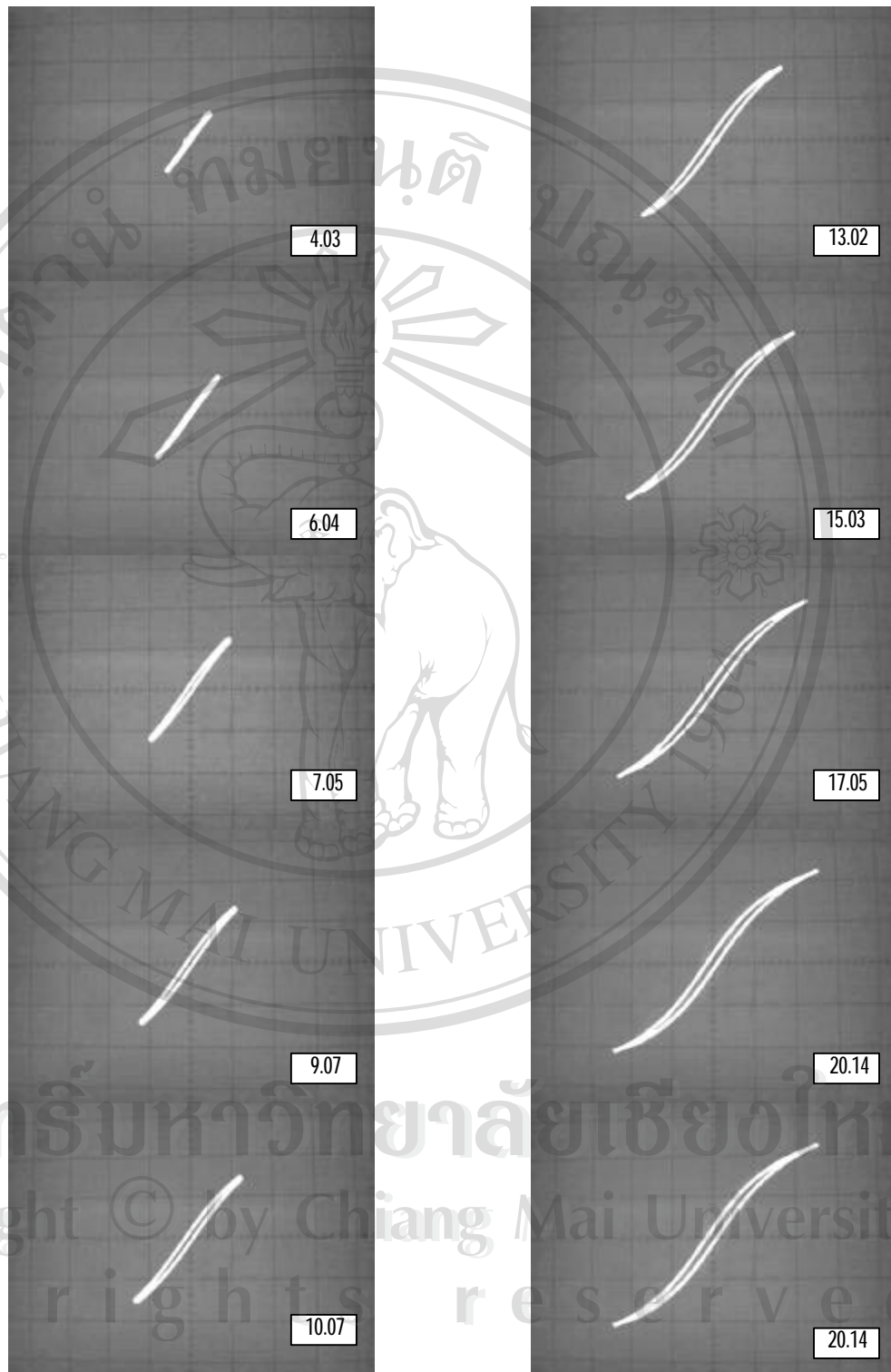


Figure A.27 Hysteresis loops evolution of PMN ceramics poled at 30 kV/cm taken at AC drive amplitudes of : 4.03 to 20.14 kV/cm

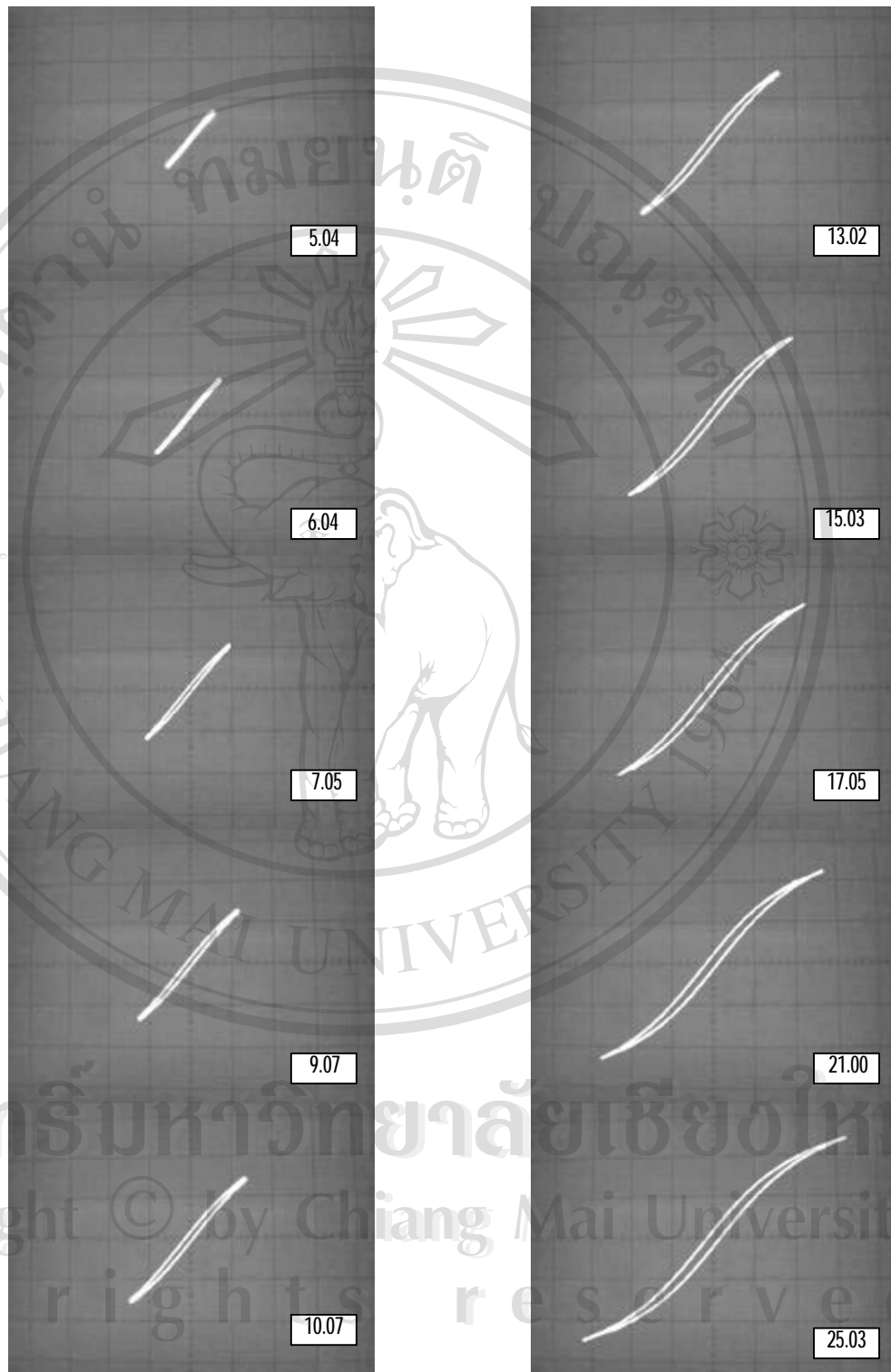


Figure A.28 Hysteresis loops evolution of PMN ceramics poled at 40 kV/cm taken at AC drive amplitudes of : 5.04 to 25.03 kV/cm

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