

**HIGH TEMPERATURE DEFORMATION OF OCTACHLOROPROPANE:  
A MICROSTRUCTURAL STUDY**

by

Jin-Han Ree

A Dissertation

Submitted to the State University of New York at Albany

in Partial Fulfillment of

the Requirements for the Degree of

Doctor of Philosophy

College of Sciences and Mathematics

Department of Geological Sciences

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## ABSTRACT

As an aid to understanding the high-temperature microstructures of rocks, the development of microstructures in the hexagonal organic material, octachloropropane, was studied with *in-situ* optical microscopy. It was found that the deformation behavior of grains in hard and soft orientations for slip is different during simple shearing, although they both grow. Strain heterogeneity is induced by partitioning of deformation into relatively increased components of rigid-body rotation and translation in hard grains and strains in soft grains.

A steady-state foliation, having a constant intensity and orientation was observed in simple shearing. The steady state is maintained by a balance between foliation-strengthening and -weakening processes. The major foliation-strengthening process is intragranular strain, and the major foliation-weakening process is dynamic recrystallization including migration of straight or slightly wavy grain boundaries, grain dissection and rotational recrystallization. Other minor weakening processes are grain amalgamation, relative rigidity of hard grains and grain boundary sliding. Foliation intensity is lower than the axial ratio of the bulk strain ellipse by a factor 0.2 - 0.4 at a total shear strain of 1.3 - 1.8, indicating that grain-shape foliations of this type cannot be used for strain calculation.

Subgrain boundaries which appear similar under optical microscopy originate in seven different ways. They are classical polygonization, kinking, misorientation reduction, grain coalescence, impingement of migrating subgrain boundaries, edgewise propagation, and static development of subgrain boundaries from optically strain-free grains. The preferred orientation of subgrain boundaries with respect to the grain-shape foliation is symmetric in pure-sheared samples and asymmetric in simple-sheared samples.

Grain boundary sliding can occur by discontinuities in the strain, rotation and/or

translation components of deformation across the boundary in deforming samples. Grain boundary diffusion and intragranular plastic deformation are found to be effective in accommodating grain boundary sliding. Grain boundary openings can develop in association with grain boundary sliding, preferentially along grain boundaries at a low angle to the shortening direction. Once grain boundary openings occur, they continuously change their shape and are eventually closed by thrusting of sliding grains and grain overgrowth into the openings. An approximately equal volume of new openings grow in other places, however, maintaining a steady ratio of 0.5 - 3% of the sample volume without development of any large scale fracture. The opening and closing of grain boundaries usually involve neighbor switching of surrounding grains.

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## TABLE OF CONTENTS

<b>ABSTRACT</b>	i
<b>ACKNOWLEDGMENTS</b>	iii
<b>TABLE OF CONTENTS</b>	v
<b>LIST OF FIGURES</b>	viii
<b>LIST OF TABLES</b>	xi
<b>CHAPTER 1. INTRODUCTION</b>	1-1
<b>CHAPTER 2. DETAILS OF EXPERIMENTS AND ANALYTICAL METHODS</b>	
2.1 INTRODUCTION	2-1
2.2 EXPERIMENTAL TECHNIQUES	2-3
2.2.1 Sample preparation	2-3
2.2.2 Deformation apparatus	2-4
2.2.3 Photographic recordings	2-6
2.2.4 c-axis measurement	2-6
2.3 ANALYTICAL METHODS	2-13
2.3.1 Calculation of deformation parameters	2-13
2.3.2 Grid and marker particle trajectory maps	2-14
2.3.3 Bulk and intragranular strains	2-15
2.3.4 Measurement of grain-shape foliation and grain boundary orientation	2-16
2.3.5 Deformation of passive grain boundaries	2-18
2.3.6 Measurement of grain area	2-19
<b>CHAPTER 3. STRAIN HETEROGENEITY, DYNAMIC GRAIN GROWTH AND LATTICE REORIENTATION</b>	
3.1 INTRODUCTION	3-1
3.2 OBSERVATIONS AND ANALYSES	3-2
3.2.1 General	3-2
3.2.2 Deformation pattern	3-6
3.2.3 Grain-size history	3-9
3.3 DYNAMIC GRAIN GROWTH AND STRAIN HETEROGENEITY	3-12
3.4 LATTICE REORIENTATION	3-19

3.4.1	c-axis trajectories	3-19
3.4.2	Lattice rotation vs. material-line rotation	3-22
3.5	TEST OF SACHS AND TAYLOR PREDICTIONS	3-28
3.6	DISCUSSION	3-32
3.7	CONCLUSIONS	3-33
<b>CHAPTER 4. DEVELOPMENT OF STEADY-STATE FOLIATION</b>		
4.1	INTRODUCTION	4-1
4.2	EXPERIMENTAL TECHNIQUES	4-2
4.3	OBSERVATIONS AND ANALYSES	4-3
4.3.1	General	4-3
4.3.2	Deformation pattern	4-8
4.3.3	c-axis reorientation	4-8
4.3.4	Grain-size history	4-13
4.3.5	Foliation history	4-13
4.4	PROCESSES FOR STEADY-STATE FOLIATION	4-19
4.5	DISCUSSION	4-27
4.6	CONCLUSIONS	4-32
<b>CHAPTER 5. MULTIPLE ORIGINS OF SUBGRAIN BOUNDARIES</b>		
5.1	INTRODUCTION	5-1
5.2	EXPERIMENTAL DESCRIPTIONS	5-1
5.2.1	Experiment TO-91	5-1
5.2.2	Experiment TO-207	5-6
5.2.3	Experiment TO-11	5-6
5.2.4	Other experiments	5-6
5.3	SEVEN TYPES OF SUBGRAIN BOUNDARIES	5-7
5.3.1	Type I subgrain boundaries	5-9
5.3.2	Type II subgrain boundaries	5-12
5.3.3	Type III subgrain boundaries	5-12
5.3.4	Type IV subgrain boundaries	5-16
5.3.5	Type V subgrain boundaries	5-22
5.3.6	Type VI subgrain boundaries	5-22
5.3.7	Type VII subgrain boundaries	5-27
5.3.8	Population of subgrain boundaries	5-30
5.4	SUBGRAIN BOUNDARY ORIENTATION AND DENSITY	5-30
5.4.1	Subgrain boundary orientation of each type	5-30



5.4.2	Evolution of subgrain boundary orientation	5-30
5.4.3	Evolution of subgrain boundary density	5-33
5.4.4	Comparison of subgrain boundaries between pure shear and simple shear	5-33
5.5	DISCUSSION	5-36
5.6	CONCLUSIONS	5-40
<b>CHAPTER 6. GRAIN BOUNDARY DEFORMATION AND DEVELOPMENT OF GRAIN BOUNDARY OPENINGS</b>		
6.1	INTRODUCTION	6-1
6.2	GRAIN BOUNDARY SLIDING AND ITS ACCOMMODATION	6-2
6.3	EXPERIMENTAL EXAMPLES	6-6
6.3.1	General	6-6
6.3.2	Experiment TO-110	6-6
6.3.3	Experiment TO-105	6-12
6.3.4	Experiment TO-202	6-23
6.4	EVOLUTION OF GRAIN BOUNDARY OPENINGS	6-29
6.5	DISCUSSION	6-37
6.5.1	Grain boundary sliding and its accommodation	6-37
6.5.2	Implication of grain boundary openings	6-38
6.5.3	Recognition of grain boundary sliding and opening	6-39
6.5.4	Three types of grain boundary migration	6-42
6.6	CONCLUSIONS	6-44
<b>REFERENCES</b>		7-1
<b>APPENDIX 1. EQUATIONS OF DEFORMATION PARAMETERS AND COMPUTER PROGRAMS</b>		
A1.1	EQUATIONS OF DEFORMATION PARAMETERS	A1-1
A1.1.1	Equations of $D_{ij}$ and $T_i$	A1-1
A1.1.2	Equations of D parameters	A1-2
A1.2	COMPUTER PROGRAMS	A1-4
A1.2.1	General	A1-4
A1.2.2	Programs GRID, MPT and TRI	A1-4
A1.2.3	Program GBO	A1-9
A1.2.4	Program GBD	A1-13

## APPENDIX 2. FURTHER DETAILS OF STEADY-STATE FOLIATION

A2.1 FOLIATION DEVELOPMENT	A2-1
A2.1.1 Sample TO-109	A2-1
A2.1.2 Sample TO-105	A2-5
A2.2 COMPARISON OF OTHER MICROSTRUCTURES AND DEFORMATION PATTERN	A2-9
A2.2.1 c-axis fabrics	A2-9
A2.2.2 Deformation pattern	A2-11
A2.2.3 Grain-size history	A2-14
A2.2.4 Grain boundary migration	A2-16
A2.3 DISCUSSION AND CONCLUSION	A2-18

## LIST OF FIGURES

2.1 Deformation geometry of the OCP sample assembly	2-5
2.2 Urai press	2-7
2.3 Photograph of Leitz Berek compensator	2-9
2.4 Relation between compensator reading and retardation	2-11
2.5 Berek compensator reading vs. c-axis plunge angle in OCP	2-12
2.6 Projection method	2-17
3.1 Maps of OCP sample TO-109	3-5
3.2 c-axis fabric diagrams of OCP sample TO-109	3-7
3.3 Marker particle trajectories of sample TO-109	3-8
3.4 Grid maps of sample TO-109	3-10
3.5 Average grain area vs. bulk shear strain of sample TO-109	3-11
3.6 Maps of TO-109 at a bulk shear strain of 1.2	3-13
3.7 Offset of material lines across grain boundary	3-14
3.8 Plots of $R_f$ vs. angle between $\sigma_1$ and c-axis	3-17
3.9 Plots of grain area vs. bulk shear strain sample TO-109	3-18
3.10 c-axis reorientation trajectories	3-20
3.11 Rotation of c-axis and $S_1$ vs. bulk shear strain	3-21
3.12 Lattice rotation ( $R_L$ ) and $S_1$ rotation ( $R_M$ )	3-23
3.13 Plots of $S_1$ vs. c-axis rotation of hard grains	3-24

3.14	Model of hard grain deformation	3-25
3.15	Test of model of hard grain deformation	3-27
3.16	Taylor/Sachs effect on dynamic grain growth	3-29
3.17	Plots of $R_f$ difference vs. orientation function difference	3-30
4.1	Maps of OCP sample TO-110	4-5
4.2	Photomicrographs of sample TO-110	4-7
4.3	Marker particle trajectories of sample TO-110	4-9
4.4	Grid maps of sample TO-110	4-10
4.5	c-axis fabric diagram of sample TO-110	4-11
4.6	c-axis reorientation trajectories of sample TO-110	4-12
4.7	Plots of average grain area vs. bulk shear strain	4-14
4.8	Projection diagrams and rose diagrams of grain boundaries	4-15
4.9	Foliation intensity and orientation plots	4-18
4.10	Trajectories of foliation and bulk finite strain	4-20
4.11	Maps of the central area of the sample	4-21
4.12	Foliation-weakening process by grain boundary migration	4-23
4.13	Foliation-weakening process by dissection	4-24
4.14	Foliation-strengthening process by rotational recrystallization	4-26
4.15	Means' (1981) loop-like plot	4-29
4.16	Plot of aspect ratio of grains against grain area	4-30
4.17	Life history of six grains	4-31
5.1	Maps of sample TO-91	5-5
5.2	Seven types of subgrain boundary development	5-8
5.3	Photomicrographs of Type I subgrain boundary	5-10
5.4	Maps of Type I subgrain boundaries	5-11
5.5	Photomicrographs of Type II subgrain boundary	5-13
5.6	Maps of Type II subgrain boundary	5-14
5.7	Photomicrographs of Type III subgrain boundary	5-15
5.8	Maps of Type III subgrain boundary in TO-91	5-17
5.9	Maps of Type III subgrain boundaries in TO-207	5-19
5.10	Maps of Type IV subgrain boundary	5-23
5.11	Photomicrographs of Type IV subgrain boundary	5-24
5.12	Photomicrographs of Type V subgrain boundary	5-25
5.13	Maps of Type V subgrain boundary	5-26

5.14	Maps of Type VI subgrain boundary in sample TO-11	5-28
5.15	Photomicrographs of Type VII subgrain boundary	5-29
5.16	Orientations of subgrain boundaries of each type	5-31
5.17	Evolution of subgrain boundary orientations	5-32
5.18	Plot of subgrain boundary density vs. bulk shear strain	5-34
5.19	Comparison of subgrain boundary orientations of samples	5-35
5.20	Comparison of subgrain boundary density of samples	5-37
6.1	Schematic diagrams of grain boundary sliding	6-4
6.2	Accommodation mechanisms of grain boundary sliding	6-5
6.3	Offset of material lines in sample TO-110	6-9
6.4	Evolution of grain boundaries in sample TO-110	6-10
6.5	Grain boundary sliding by rotation jump in TO-110	6-13
6.6	Offset of a marker line in sample TO-110	6-15
6.7	Photomicrographs of sample TO-105	6-18
6.8	c-axis fabric diagrams of sample TO-105	6-19
6.9	Grain boundary sliding by translation jump in TO-105	6-22
6.10	Grain boundary sliding by rotation jump in TO-105	6-25
6.11	Grain boundary sliding by translation jump in TO-207	6-28
6.12	Evolution of grain boundary openings	6-30
6.13	Photomicrographs of TO-88 and TO-89	6-31
6.14	Plot of bulk strain vs. grain boundary openings ratio	6-32
6.15	Residence time of grain boundary openings in TO-105	6-33
6.16	Opening and closing of grain boundaries in TO-202	6-35
6.17	Orientations of grain boundary openings	6-36
6.18	Grain boundary orientations	6-41
6.19	Three types of grain boundary migration	6-43
A1.1	Mohr circle for a deformation tensor <b>D</b>	A1-3
A1.2	Flow chart of program GRID	A1-6
A1.3	Flow chart of program MPT	A1-7
A1.4	Flow chart of program TRI	A1-8
A1.5	Flow chart of program GBO	A1-10
A1.6	An example of projection method	A1-11
A1.7	Examples of projection method	A1-12
A1.8	Flow chart of program GBD	A1-14

A2.1	Projection diagrams and rose diagrams of TO-109	A2-2
A2.2	Plots of foliation intensity vs. bulk shear strain of samples	A2-4
A2.3	Plots of foliation orientation vs. bulk shear strain of samples	A2-6
A2.4	Projection diagrams and rose diagrams of TO-105	A2-7
A2.5	Comparison of c-axis fabric diagram of samples	A2-10
A2.6	Comparison of marker particle trajectories of samples	A2-13
A2.7	Comparison of grain size of samples	A2-15
A2.8	Comparison of grain boundary migration of samples	A2-17

## LIST OF TABLES

2.1	Synkinematic microscopy research since 1980	2-2
2.2	Motors for Urai press	2-8
3.1	Conditions of experimental deformation	3-3
5.1	Conditions of experimental deformation	5-2
6.1	Conditions of experimental deformation	6-7
A1.1	Computer programs	A1-5