Laboratory Tests at higher Temperature on different Facies types of WIPP Salt

Sandia National Laboratories

Verantwortung für Generationen
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- Aim of the investigations

  complementation of the tests of other companions
- Creep tests at higher temperature on different facies types
- Overview of the test programm
- Results
- Current and future works
- Petrophysical investigations
- Mineralogy
- Results
- Future works

- Analyzed Material

File 13084 clean salt

File 13085 clean salt

File 13079 arg. salt

File 14008 arg. salt

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- Clean salt (mineralogy)
- Water content ≈ 2.5 w.-% (after Rietveld)!!
- Mineralogy (after Rietveld)

Probe	Halit	Polyhalit	Anhydrit	Kieserit	Qz/Illit/Mag.
2.01	99	0.5			0.5
2.29	99		0.7		0.5
102-5 rot	96	3	≤1	≤1	
102-5 grau	99			≤1	
104 rot	99	≤1			
104 grau	100				
105-5 rot	99		1		
105-5 grau	99		≤1	≤1	

- What have we done?

- 9 uniaxial creep tests with two stress steps (14 and 16 MPa)
- each step 70 days
- 4 uniaxial creep tests at higher temperature (100 and 120 °C)
- *All tests happened at argillaceous salt*

- 3 triaxial creep tests at higher temperature (40 and 140°C)
- *Tests happened on clean and argillaceous salt (partly performed in 2001)*

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Data sets creep tests

File	Versuch	σ 3	Δσ	Temp.	Kriechrate	Klasse	Gesetz	Verformung	Fazies	Bemerkungen
		MPA	MPA	°C	1/d		BGR	%		
14002	Kriech1	0	14	22	4.20E-05	5	a	1.97	argillaceous	
14002	Kriech1	0	16	22	1.10E-04	6	a	1.49	argillaceous	
14003	Kriech1	0	14	22	4.40E-05	5	a	1.94	argillaceous	
14003	Kriech1	0	16	22	1.20E-04	6	a	1.59	argillaceous	
14004	Kriech1	0	14	22	8.00E-05	6	a	2.09	argillaceous	
14004	Kriech1	0	16	22	1.60E-04	6	a	2.21	argillaceous	
14005	Kriech1	0	14	22	4.90E-05	5	a	2.28	argillaceous	
14005	Kriech1	0	16	22	1.50E-04	6	a	1.73	argillaceous	
14006	Kriech1	0	14	22	5.90E-05	6	a	1.88	argillaceous	
14006	Kriech1	0	16	22	1.50E-04	6	a	1.93	argillaceous	
13076	Kriech1	0	13.9	22	9.00E-05	6	a	2.61	argillaceous	
13076	Kriech1	0	15.6	22	6.00E-04	8	a	3.11	argillaceous	
13078	Kriech1	0	13.9	22	1.00E-04	6	a	2.55	argillaceous	
13078	Kriech1	0	15.1	22	Bruch		a		argillaceous	
13079	Kriech1	0	14.2	22	5.20E-06	2	a	0.29	argillaceous	
13079	Kriech1	0	16.4	22	2.00E-05	3	a	0.05	argillaceous	
13080	Kriech1	0	14.1	22	4.00E-05	5	a	2.75	argillaceous	
13080	Kriech1	0	16.1	22	1.40E-04	6	a	1.42	argillaceous	
14008	TKriech1	0	6	100	1.70E-04	10	b	2.1	argillaceous	
14009	TKriech1	0	5.9	120	4.90E-04	9	b	3.68	argillaceous	
14010	TKriech1	0		120			b		argillaceous	
14011	TKriech1	0	6.1	120	4.10E-04	9	b	3.19	argillaceous	
14012	TKriech1	0	6	100	1.40E-04	9	b	1.7	argillaceous	
13084	Tkriech3			120			b		clean	
13085	Tkriech3	20	4	140	2.00E-04	9	b		clean	
13085	Tkriech3	20	2	140	3.00E-06	7	b		clean	
1096	Tkriech3	12	14	40	2.30E-04	9	b		argillaceous	performed 2001
1096	Tkriech3	20	14	40	1.70E-04	5	b		argillaceous	performed 2001
1096	Tkriech3	2	14	40	4.30E-04	10	b		argillaceous	performed 2001
1096	Tkriech3	1	14	40	1.30E-04	11	b		argillaceous	performed 2001
1096	Tkriech3	20	14	40	2.50E-04	9	b		argillaceous	performed 2001
1097	Tkriech3	12	14	40	7.30E-05	7	b		clean	performed 2001
1097	Tkriech3	20	14	40	7.10E-05	7	b		clean	performed 2001
1097	Tkriech3	2	14	40	1.30E-04	8	b		clean	performed 2001
1097	Tkriech3	1	14	40	1.70E-04	8	b		clean	performed 2001
1097	Tkriech3	20	14	40	5.20E-05	7	b		clean	performed 2001
										performed 2001
169	FKriech1	0	14	22	2.50E-05	4	a		argillaceous	performed 2001
170	FKriech1	0	14	22	2.70E-05	5	a		clean	performed 2001

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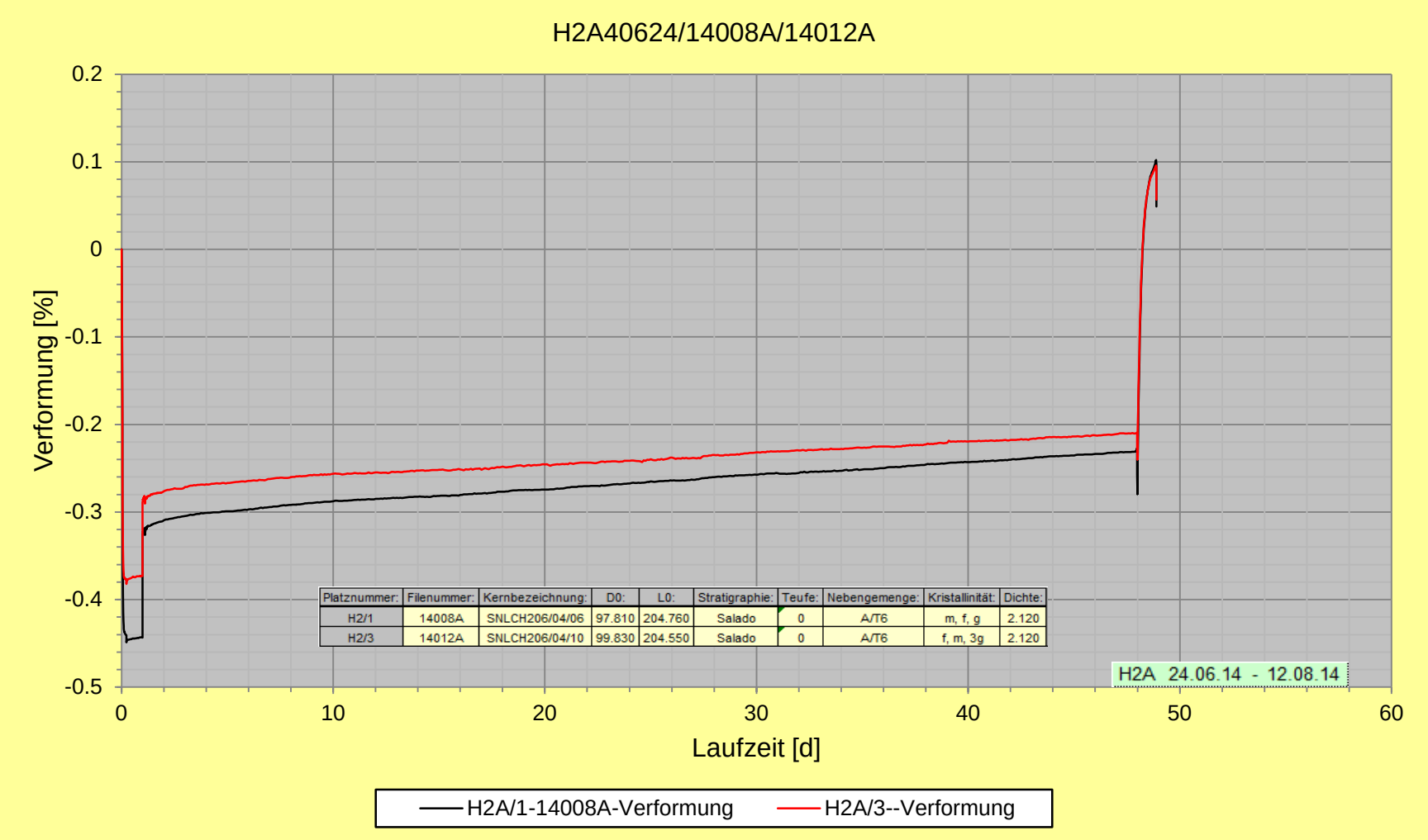
Uniaxial Creep test on argillaceous salt from the WIPP-site at 100 ° C



Platznummer:	Filenummer:	Kernbezeichnung:	D0:	L0:	Stratigraphie:	Teufe:	Nebengemenge:	Kristallinität:	Dichte:
H2/1	14008A	SNLCH206/04/06	97.810	204.760	Salado	0	A/T6	m, f, g	2.120
H2/3	14012A	SNLCH206/04/10	99.830	204.550	Salado	0	A/T6	f, m, 3g	2.120

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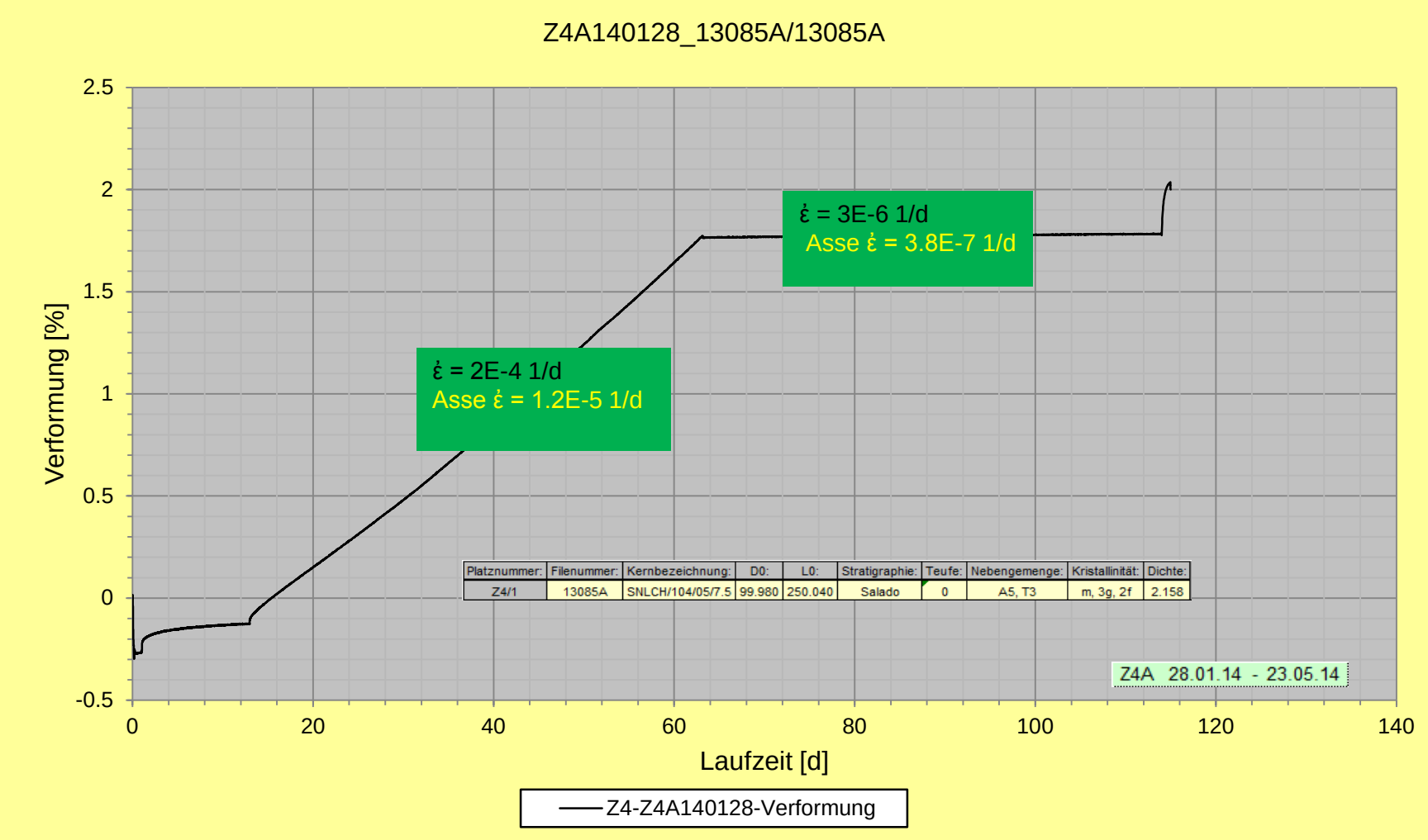
Triaxial Creep test on argillaceous salt from the WIPP-site at 140 ° C
(sigma 3 = 20 MPa) stress step 1 Δσ = 4 MPa, stress step 2 Δσ = 2 MPa



Platznummer:	Filenummer:	Kernbezeichnung:	D0:	L0:	Stratigraphie:	Teufe:	Nebengemenge:	Kristallinität:	Dichte:
Z4/1	13085A	SNLCH/104/05/7.5	99.980	250.040	Salado	0	A5, T3	m, 3g, 2f	2.158

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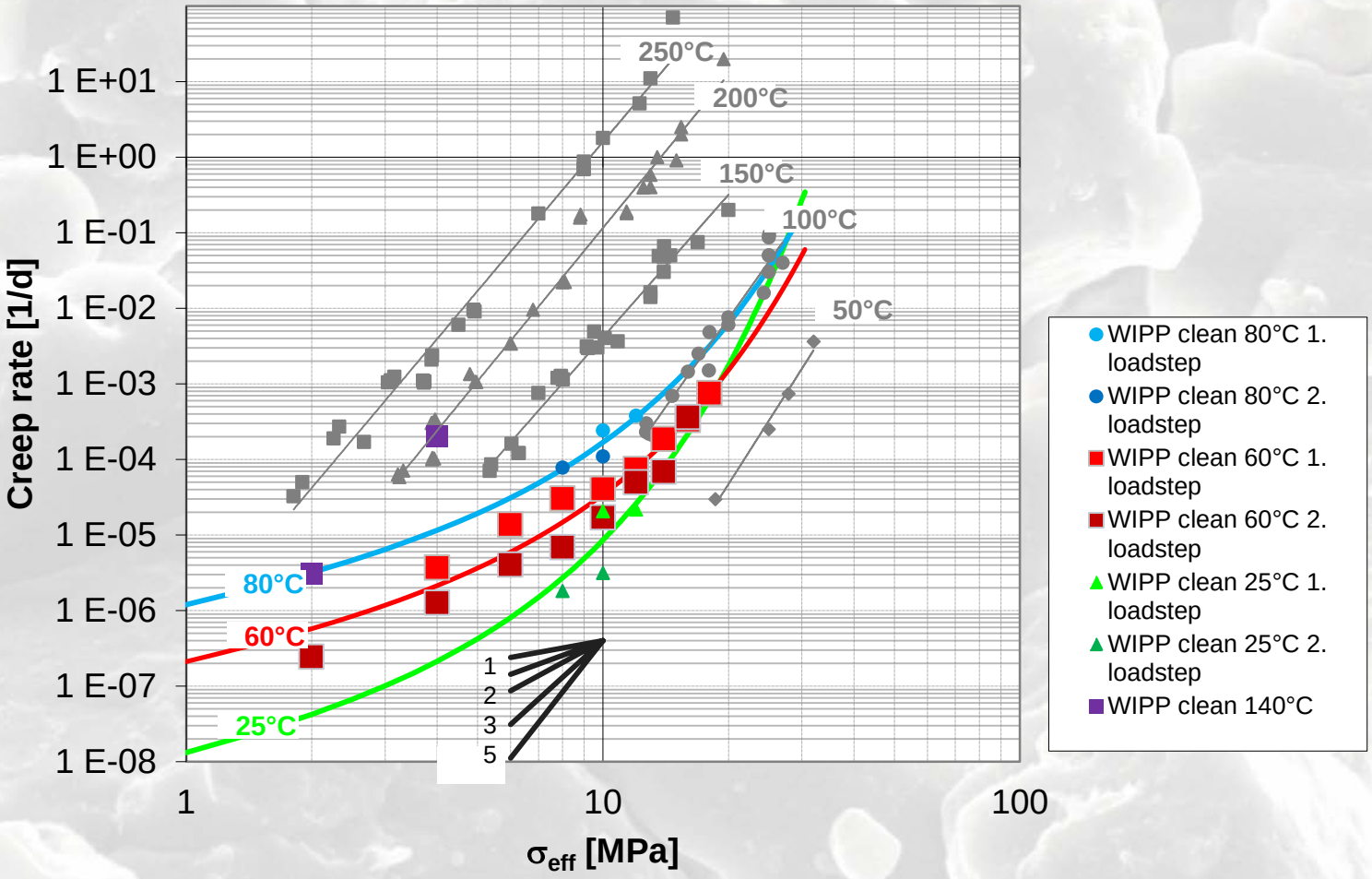

- Summary:
- Argillaceous salt creeps slightly faster than „Asse Speisesalz“ at normal temperature
- It creeps up to two orders of magnitude faster than „Asse Speisesalz“ at higher temperatures
- Clean salt creeps up to one order of magnitude faster than „Asse Speisesalz“ at higher temperatures

- Water content measured after Rietveld is five times higher than measured at baking out

- Future works:
- Complementary triaxial tests at higher temperatur at both facies types
- Investigations to determine the influence of the microstructure
- Better determination of the moisture content (freeze desalination?)

  (performed by group of Mr. Hammer)

- What we need:
- More material from the WIPP-site!
- Is this possible?

Thank you for your attention