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GENERAL INFORMATION

1. Title of Dataset: Dataset: Mechanical, thermal, and structural investigations of chemically strengthened Na2O–CaO–Al2O3–SiO2 glasses

2. Author Information

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3. Date of data collection: 2019-01-01 to 2022-09-08

4. Geographic location of data collection: Växjö (Sweden), Tallinn (Estonia), Stockholm (Sweden)

5. Information about funding sources that supported the collection of the data: FORMAS, the Swedish Research Council for Sustainable Development, Grant No. 2018-00707.

SHARING/ACCESS INFORMATION

1. Licenses/restrictions placed on the data: Creative Commons Attribution License (CC BY)

2. Links to publications that cite or use the data:
Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

3. Links to other publicly accessible locations of the data: N/A

4. Links/relationships to ancillary data sets: N/A

5. Was data derived from another source? No

6. Recommended citation for this dataset:
Karlsson, S., Mathew, R., Ali, S., Paemurru, M., B. Stevensson, Anton, J., and Edén, M. (2022). Dataset: Mechanical, thermal, and structural investigations of chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses. DOI: https://doi.org/10.5878/w6c3-hk86

DATA & FILE OVERVIEW

1. File List:

NMR:
^{27}Al NMR: Al3_AlNMR.zip, Al5_AlNMR.zip, Al6_AlNMR.zip, Al3-CS_AlNMR.zip, Al5-CS_AlNMR.zip, Al6-CS_AlNMR.zip
^{23}Na NMR: Al1_NaNMR.zip, Al3_NaNMR.zip, Al5_NaNMR.zip, Al6_NaNMR.zip, Al1-CS_NaNMR.zip, Al3-CS_NaNMR.zip, Al5-CS_NaNMR.zip, Al6-CS_NaNMR.zip

SCALP: Al_CS_SCALP.csv

TGA: Al1-6TGA.txt, Al1-6CSTGA.txt

DTA: Al1-6DTA.txt, Al1-6CSDTA.txt

Nanoindentation: Al-Nanoindenter_Pristine.csv, Al-Nanoindenter_CS-5h.csv, Al-Nanoindenter_CS-16h.csv

Crack Resistance: Al-CR.csv

2. Relationship between files, if important:
Those starting with "CS" corresponds to chemically strengthened samples and "5h" or "16h" denotes the duration of the chemical strengthening process. The same notation is used in the scientific publication:
Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

In addition, there is a sample key for dataset-to-publication where (L can be upper- or lowercase, *i.e.*, L/l):
AL1 = Al0
AL2 = Al4
AL3 = Al8
AL4 = Al12
AL5 = Al16
AL6 = Al20

3. Additional related data collected that was not included in the current data package: Given in scientific publication: Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

4. Are there multiple versions of the dataset? No

METHODOLOGICAL INFORMATION

1. Description of methods used for collection/generation of data:
Please find all relevant information in the following scientific paper:
Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

2. Methods for processing the data:
Please find all relevant information in the following scientific paper:
Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

3. Instrument- or software-specific information needed to interpret the data:

NMR: All data can be read using Bruker TopSpin software.

4. Standards and calibration information, if appropriate:
Please find all relevant information in the following scientific paper:
Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

5. Environmental/experimental conditions:
Please find all relevant information in the following scientific paper:
Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

6. Describe any quality-assurance procedures performed on the data:
Please find all relevant information in the following scientific paper:
Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

7. People involved with sample collection, processing, analysis and/or submission:
A. Stefan Karlsson
B. Renny Mathew
C. Sharafat Ali
D. Mart Paemurru
E. Johan Anton
F. Baltzar Stevensson
G. Mattias Edén

DATA-SPECIFIC INFORMATION FOR NMR: ^{27}Al NMR: Al3_AlNMR.zip, Al5_AlNMR.zip, Al6_AlNMR.zip, Al3-CS_AlNMR.zip, Al5-CS_AlNMR.zip, Al6-CS_AlNMR.zip
^{23}Na NMR: Al1_NaNMR.zip, Al3_NaNMR.zip, Al5_NaNMR.zip, Al6_NaNMR.zip, Al1-CS_NaNMR.zip, Al3-CS_NaNMR.zip, Al5-CS_NaNMR.zip, Al6-CS_NaNMR.zip

1. Number of variables: N/A

2. Number of cases/rows: N/A

3. Variable List:
Important files included in each folder
fid-complex (real+imaginary) raw data acquired in time domain
pdata/1/1r- processed real data in frequency domain

4. Missing data codes:
Key code for identifying sample in relation to the publication: Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

Al1 = Al0
Al3 = Al8
Al5 = Al16
Al6 = Al20

5. Specialized formats or other abbreviations used: N/A

DATA-SPECIFIC INFORMATION FOR SCALP: Al_CS_SCALP.csv
1. Number of variables:
2 for each sample given as the average of three individual measurements.
2. Number of cases/rows:
297-311
3. Variable List:
Depth in mm
Stress in MPa

4. Missing data codes:
Key code for identifying sample in relation to the publication: Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

AL1 = Al0
AL2 = Al4
AL3 = Al8
AL4 = Al12
AL5 = Al16
AL6 = Al20

5. Specialized formats or other abbreviations used: N/A

DATA-SPECIFIC INFORMATION FOR TGA: Al1-6TGA.txt, Al1-6CSTGA.txt

1. Number of variables:
2 for each sample
2. Number of cases/rows:
269
3. Variable List:
Temp. / øC = Temperature in °C.
Mass /% = Mass loss/gain in % where start is 100%. Note that it is given for all samples in same txt-file in order Al1, Al2, …, Al6.

4. Missing data codes:

Key code for identifying sample in relation to the publication: Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

Al1 = Al0
Al2 = Al4
Al3 = Al8
Al4 = Al12
Al5 = Al16
Al6 = Al20

5. Specialized formats or other abbreviations used: N/A

DATA-SPECIFIC INFORMATION FOR DTA: Al1-6DTA.txt, Al1-6CSDTA.txt

1. Number of variables:
2 for each sample
2. Number of cases/rows:
267
3. Variable List:
Temp. / øC = Temperature in °C.
DSC /(mW/mg) = DTA recording in mW/mg. Note that it is given for all samples in same txt-file in order Al1, Al2, …, Al6.

4. Missing data codes:
Key code for identifying sample in relation to the publication: Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

Al1 = Al0
Al2 = Al4
Al3 = Al8
Al4 = Al12
Al5 = Al16
Al6 = Al20

5. Specialized formats or other abbreviations used: N/A

DATA-SPECIFIC INFORMATION FOR Nanoindentation: Al-Nanoindenter_Pristine.csv, Al-Nanoindenter_CS-5h.csv, Al-Nanoindenter_CS-16h.csv

1. Number of variables:
6 for each sample incl. standard deviation (Std Dev) for all data.
2. Number of cases/rows:
6 for each sample
3. Variable List:
HIT (O&P) = Indentation Hardness by Oliver and Pharr method in MPa and in GPa.
Er (O&P) = Reduced Elastic Modulus by Oliver and Pharr method in GPa.
hm = Maximum contact depth in nm by Oliver and Pharr method.
Fm = Force by Oliver and Pharr method.
N = number of selected indentations from the collected indentations.

4. Missing data codes:
Key code for identifying sample in relation to the publication: Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on*

chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses. Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

Al1 = Al0
Al2 = Al4
Al3 = Al8
Al4 = Al12
Al5 = Al16
Al6 = Al20

5. Specialized formats or other abbreviations used: N/A

DATA-SPECIFIC INFORMATION FOR Crack resistance: Al-CR.csv

1. Number of variables:
4 for each load.
2. Number of cases/rows:
Minimum 4 per samples.
3. Variable List:
Load in N
Amount of radial cracks as recorded from optical microscopy images after indentations.
Percentage of crack initiation in % as calculated from amount of radial cracks.
Standard deviation as calculated from amount of radial cracks.

4. Missing data codes:
Key code for identifying sample in relation to the publication: Karlsson, S., R. Mathew, S. Ali, M. Paemurru, J. Anton, B. Stevensson, and M. Edén, *Mechanical, thermal, and structural investigations on chemically strengthened Na_2O–CaO–Al_2O_3–SiO_2 glasses.* Frontiers in Materials, 2022. **9**: p. 953759. DOI: 10.3389/fmats.2022.953759.

Al1 = Al0
Al2 = Al4
Al3 = Al8
Al4 = Al12
Al5 = Al16
Al6 = Al20

5. Specialized formats or other abbreviations used: N/A