



Citation for published version:

Zeidler, A, Wezka, K, Rowlands, R, Whittaker, DAJ, Salmon, PS, Polidori, A, Drewitt, JWE, Klotz, S, Fischer, HE, Wilding, MC, Bull, CL, Tucker, MG & Wilson, M 2015, 'Networks under pressure', *ISIS Annual Review*, pp. 18.

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

[Link to publication](#)

University of Bath

Alternative formats

If you require this document in an alternative format, please contact:
openaccess@bath.ac.uk

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Rock and ice

Networks under pressure

A Zeidler, K Wezka, RF Rowlands, DAJ Whittaker, PS Salmon, A Polidori (University of Bath), JWE Drewitt (University of Edinburgh), S Klotz (Université Pierre et Marie Curie, France), HE Fischer (Insitut Laue-Langevin), MC Wilding (University of Aberystwyth), CL Bull, MG Tucker (ISIS), M Wilson (University of Oxford)

Instruments: Pearl, D4c (ILL).

Research support: EPSRC, University of Bath, ILL.

Contact: Philip Salmon, P.S.Salmon@bath.ac.uk

Further information: A Zeidler et al., Phys. Rev. Lett. 113 (2014) 135501.

Silica is a major component in the sand on a beach and in the rocks below our feet, pointing to its widespread abundance on Earth. As a glass, the material is exploited to make the fibres used for optical telecommunication systems, and its behaviour under pressure serves as a reference for geophysically relevant silicates. At ambient conditions, the atomic-scale structure is built from a network of corner-sharing SiO_4 tetrahedral motifs that link to form open ring-like arrangements. But how does this network respond when high pressures are applied? We investigated this issue by combining neutron and X-ray diffraction experiments with molecular dynamics computer simulations. The results show that the network collapses via a process in which rings are 'zipped' by a pairing of higher-coordinated Si atoms, namely those at the centres of the SiO_5 and SiO_6 motifs that are coaxed into existence. The work provides a starting point for predicting how such changes to a network's connectivity govern its physical properties.

Right: As the pressure on SiO_2 glass is increased (bottom to top), 4-fold coordinated Si atoms (red) convert to 5-fold coordinated Si atoms (yellow) that cluster together.

