Network glass structure : a neutron scattering study

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An account is given of recent neutron diffraction and inelastic scattering studies of a number of different network glass-forming systems, using a combination of steady-state reactor and pulsed neutron sources. Both oxide and chalcogenide systems have been investigated and the interrelationship between their various network structures are discussed. The samples studied by diffraction include single component glasses and binary systems, consisting of a network modifier plus a network former, and the data have been extended to high values of the scattering vector, Q, to achieve high real space resolution. Peak fitting techniques are employed to extract the detailed geometry of the basic structural units and to investigate the distortions caused by the introduction of network modifiers. The data obtained are compared to various structural models and computer simulations to study the intermediate range order and to test current theories concerning the role of network modifiers in binary systems. These comparisons correctly include the necessary peak functions, which define the experimental resolution in real space, and are made on a quantitative basis by the use of an appropriate reliability factor. For a number of glasses, the diffraction data are complemented by inelastic scattering measurements of the neutron weighted density of vibrational states in order to obtain further structural information, such as the role played by small planar ring systems and by superstructural units in borate glasses. Conclusions are drawn not only with regard to the validity of the various structural models but also concerning the network topology and the environment and spatial distribution of the network modifying cations. (E-mail: a.c.wright@rdg.ac.uk)