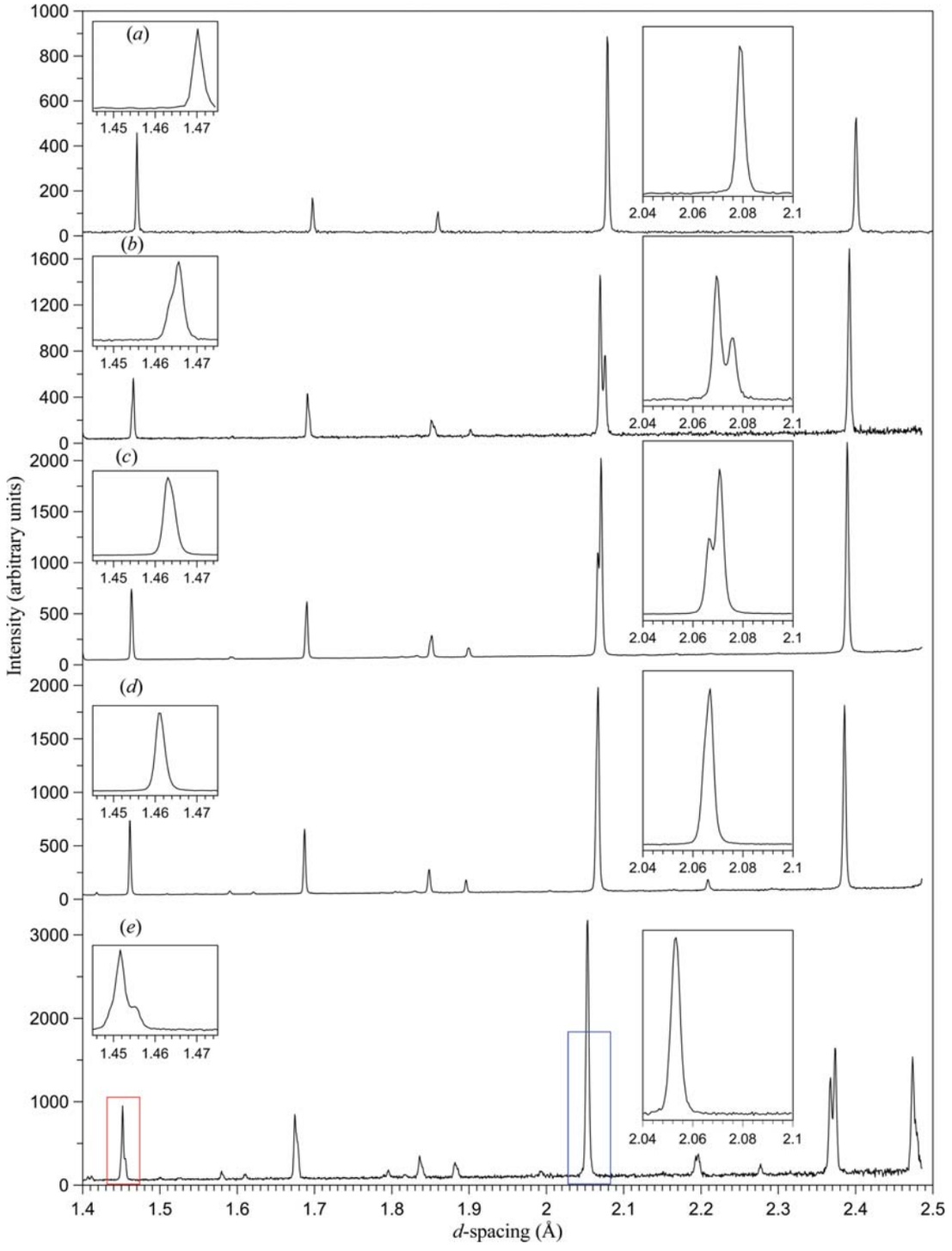

Figure 2.3.20
Parts of the very high resolution neutron powder-diffraction patterns recorded by the backscattering detector bank on the instrument HRPD at ISIS from $SrZrO_3$ at (*a*) 1403, (*b*) 1153, (*c*) 1053, (*d*) 933 and (*e*) 293 K. Insets to the left and right show subtle changes to the reflection shapes and splitting of reflections due to phase transitions from the cubic ($Pm\bar{3}m$) in pattern (*a*), to the tetragonal phase ($I4/mcm$) in (*b*), an orthorhombic phase (*Imma*) in (*c*) and a second orthorhombic phase (*Pnma*) in (*d*) and (*e*). Note the intensity reversal in the 002 reflection (right insets), which was pivotal in finding and solving the orthorhombic phase in *Imma* (Howard *et al.*, 2000).

this may be converted into the stress tensor, the desired outcome for engineering purposes (Noyan & Cohen, 1987; Fitzpatrick & Lodini, 2003; Kisi & Howard, 2008). This procedure is widely used in residual stress analysis to study stress distributions in fabricated or welded components and also to observe the internal stress distribution due to an externally imposed load. An example is illustrated in Fig. 2.3.23 in relation to *in situ* experiments and the stress distribution in granular materials.

The required localization of the gauge volume is achieved by shaping the incident and diffracted beams with slits/collimators and is greatly assisted by fixing the diffraction angle 2θ at $\pm 90^\circ$. In CW instruments, the need for high resolution and good intensity is met by using a focusing (bent Si) monochromator and a small area detector to record the data. This generally limits the investigation to a single Bragg peak (reflection), the position of which is carefully mapped over the sampled area for each strain component under investigation.