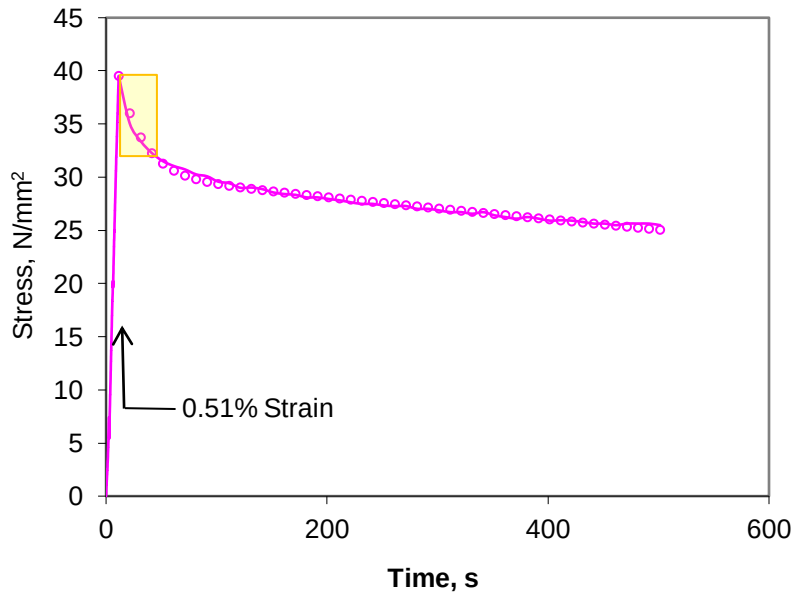
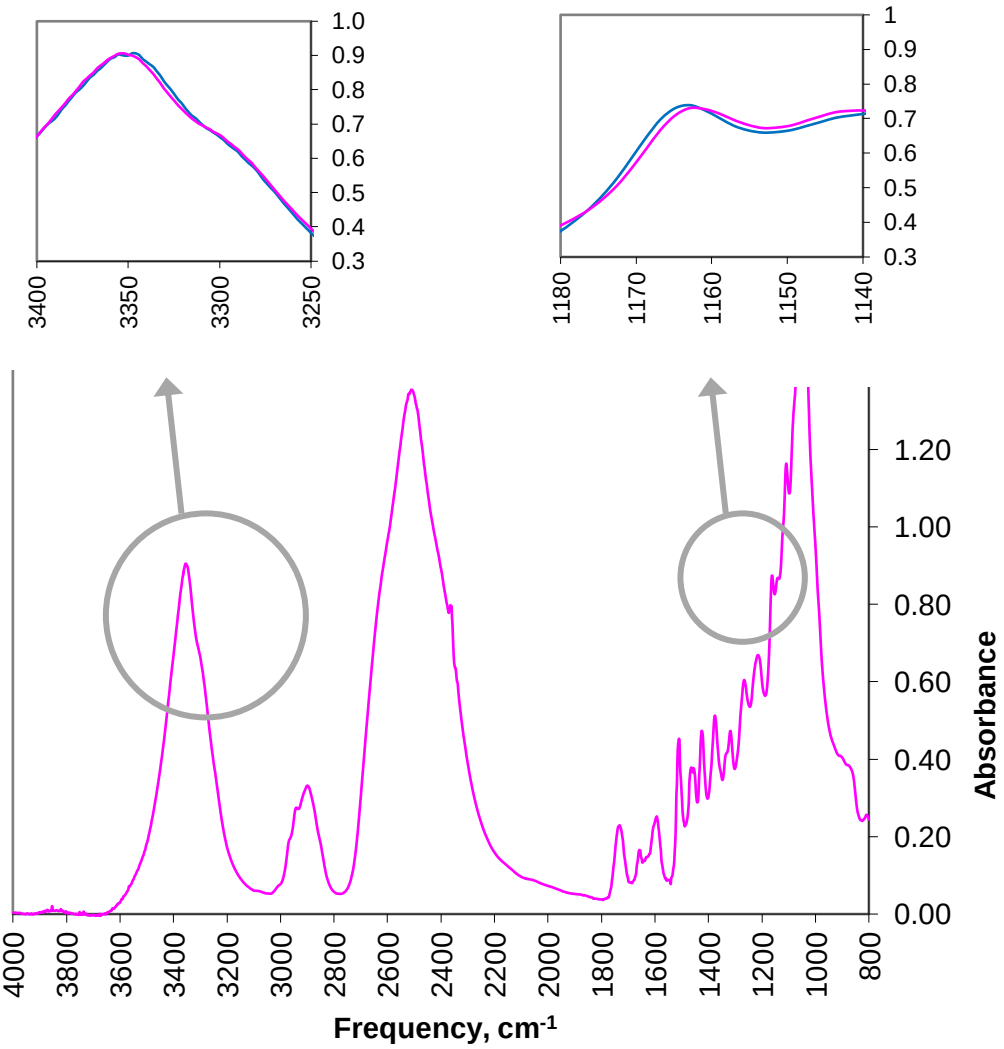
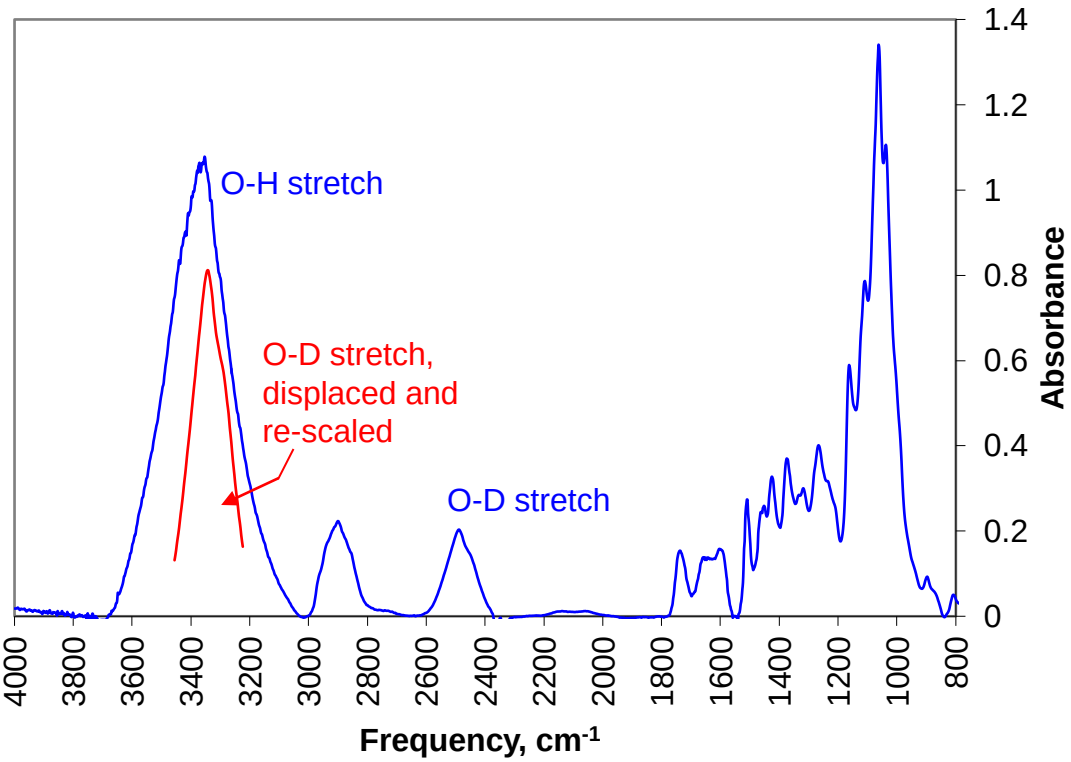


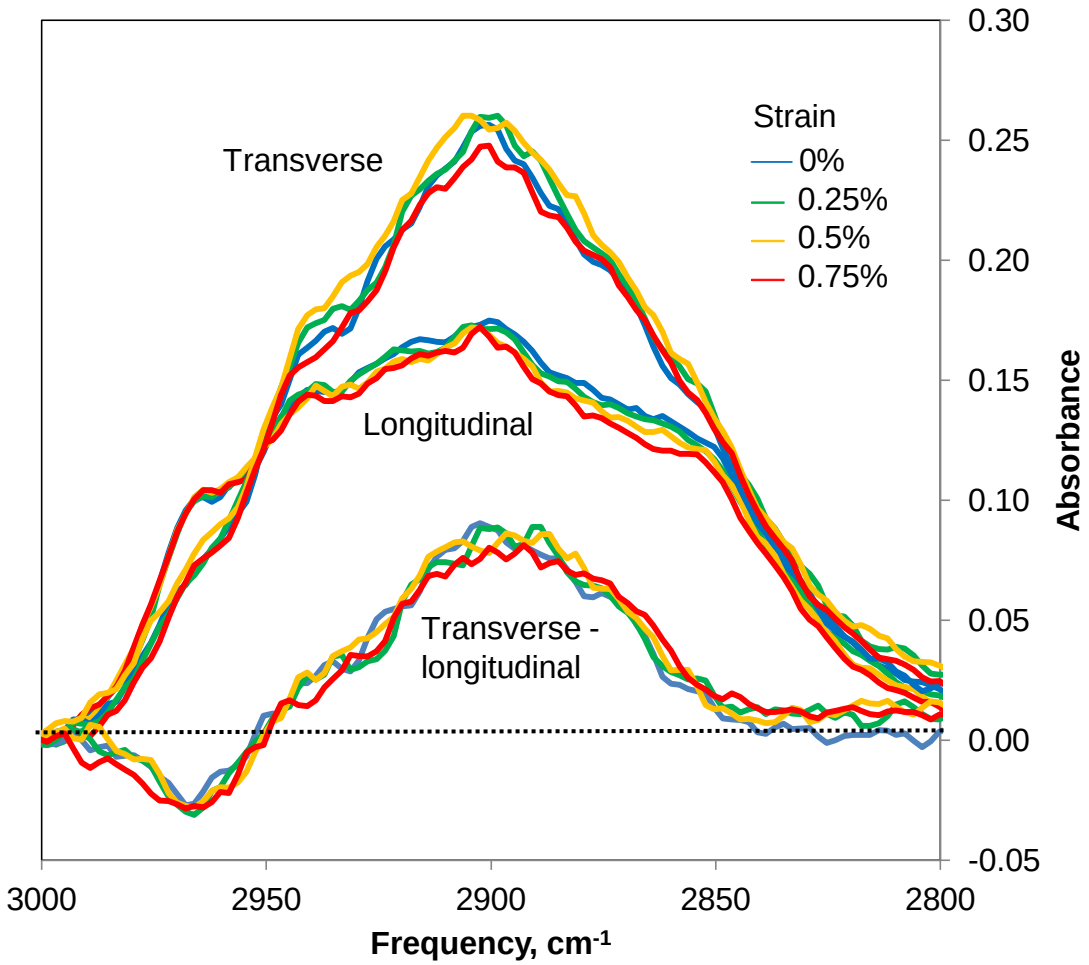
Supplementary Figure 1. Stretching and stress relaxation of Sitka spruce wood. The rectangle shows the time period of 30 s required for an FTIR spectrum to be recorded after application of tensile stress. Stress relaxation reduced the mean stress during this period by ~10% compared to the initial stress.



Supplementary Figure 2. FTIR spectrum of spruce wood after vapour-phase deuteration. Inset left: O-H stretching region expanded showing shift to higher frequency under tension. The shoulder at about 3280 cm^{-1} did not shift. Inset right: glycosidic C-O-C stretching peak at 1162 cm^{-1}, which shifted to lower frequency under tension. Blue line: mean of 4 spectra at 0.2% mean axial strain. Red line: mean of 4 spectra at 2.6% mean axial strain.



Supplementary Figure 3. Partial internal deuteration of spruce wood cellulose, leading to a stable O-D stretching band at 2400-2600 cm^{-1}. The reduced frequency of the O-D stretching band, by a factor of 1/1.343 compared to the O-H stretching band at 3200-3600 cm^{-1}, results from the greater mass of the deuterium atom. The O-D stretching bands are also shown displaced by a frequency factor of 1.343 to move them to the O-H stretching region, and scaled x3 in intensity for comparison



Supplementary Figure 4. The C-H stretching region of the polarised FTIR spectra of Sitka spruce cellulose under varying tensile strain.. The difference spectra (Transverse – longitudinal) were calculated after normalisation to equal integral intensity at each strain level.