Piezoelectricity in quartz

A quartz crystal microbalance is often used to sense changes in mass. In this device, quartz is used as a piezoelectric material. Quartz crystal microbalances do not work at temperatures higher than 573°C. Why don’t quartz crystal microbalances work at high temperature?

The function of a quartz microbalance is the detection of changes in frequency. A quartz crystal is used as resonator with certain resonance frequency $f_R$. Addition or removal of mass on the area of the oscillating quartz shifts $f_R$.

At 573°C Quartz undergoes a structural phase transition from $\alpha$- to $\beta$-Quartz. The crystal structure changes from triagonal (Hermann–Mauguin notation 32 or Schönflies-symbol D3) to hexagonal (622, D6) symmetry. Piezoelectricity is described by a rank 3 tensor. Both symmetries allow piezoelectricity, but due to the phase transition the piezoelectric behavior and the dimensions of the crystal change. Consequently the resonance frequency also changes.