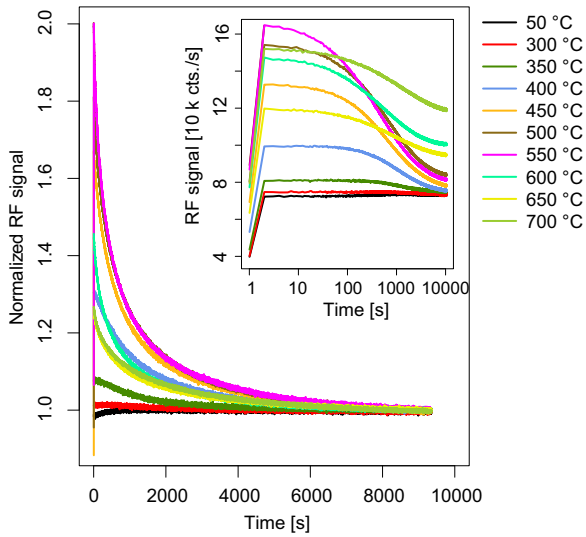

Fig. 2. UV-RF signal for sample BT1195 for different preheat temperatures (holding for 120 s). The values are normalized to the last data point of each measurement. The total absorbed dose was 600 Gy during each RF measurement. For the sake of clarity the UV-RF curves for preheat temperatures from 100 °C to 250 °C were removed, because no change was observed. The inset shows the same data as the main figure but with absolute values and a logarithmic x-axis.

counts than the following ones. Note the very high signal intensities and the behaviour of the RF signal at 700 °C.

Fig. 3 shows the initial signal of the RF curves from Figs. 1 and 2 normalized to the highest signal at 550 °C. Here all measured preheat temperatures are used and no differences are observed for preheat temperatures from 100 °C to 250 °C. For both samples a strong peak at 550 °C is observable. The sharp increase and decrease at lower and higher temperatures, respectively, indicate a change in the RF signal behaviour. The term 'initial signal' is used as the difference between the second and the last data point measured.

A similar behaviour to that of sample BT586 was observed for sample BT1195 (see Fig. 2). However, both samples show a slightly different behaviour as the signals with a preheat temperature from 50 °C to 250 °C first increase and at temperatures from 350 °C to 650 °C the decrease is getting steeper the higher the temperatures become. Such a rapid change in the signal dynamics is not observed for sample BT586 and the decrease of the signal is faster

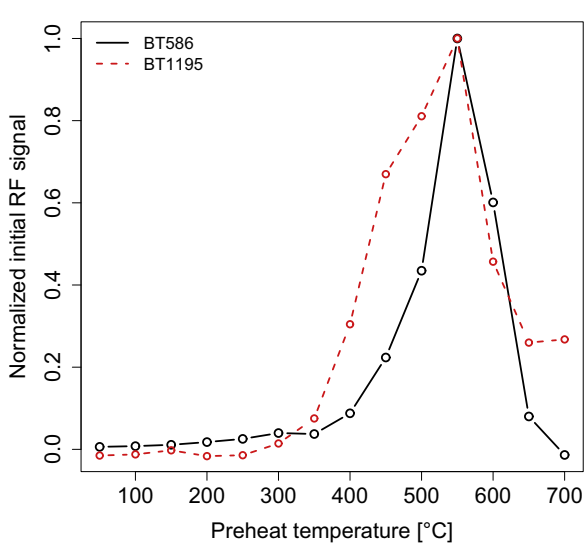

Fig. 3. Initial UV-RF signal for different preheat temperatures (holding for 120 s) for samples BT586 and BT1195 normalized to the initial signal at 550 °C.

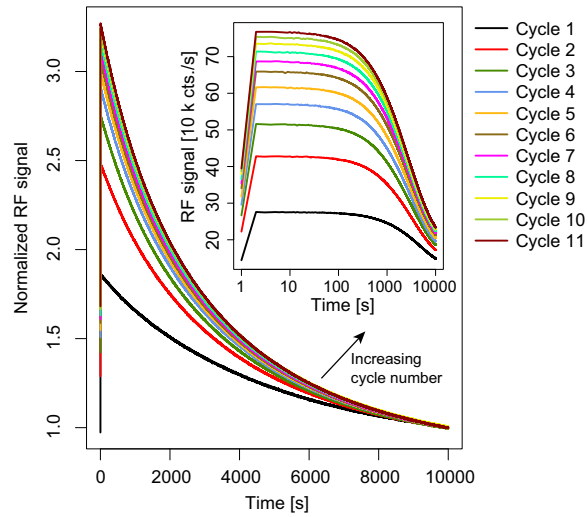

Fig. 4. UV-RF signals for sample BT586 for 11 cycles for a preheat at 500 °C for 120 s between each cycle. The total absorbed dose was 600 Gy for each RF cycle. The curves are normalized to the last data point. The inset shows the same data as the main figure but with absolute values and a logarithmic x-axis.

than for BT586. The differences between 650 °C and 700 °C are much smaller than for BT586. The inset in Fig. 2 shows that the signal intensities are lower by a factor ~3 (for 550 °C) in contrast to sample BT586.

3.2. Signal stability tests

To test the UV-RF signal stability for repeated measurement cycles, a second experiment was designed measuring the RF signal 11 times with a constant preheat of 500 °C (5 K s^{-1}, holding time 120 s) prior to each signal readout.

A similar measurement was performed by Martini et al. [13, Fig. 4] and they observed an enhancement of the 3.44 eV (360 nm) band after each cycle. In contrast to Martini et al. [13] we did not measure a spectrum, but measured only the UV wavelength region (see Section 2.2). Fig. 4 shows the results of these measurements, again normalized to the last data point. The first two cycles show different slopes than the other ones. For cycles 3 to 11 the slope of the curves is not changing, only the signal intensity increases. The inset shows the same data as in the main figure, but on a logarithmic x-axis and with absolute count values for the RF signal. Here the successive increase of the initial signal by a factor of ~3 over 11 cycles is observed as well as similar curve shapes. Analogue UV-RF signal behaviour was found for sample BT1195 (not shown here). Our results are in accordance with the results by Martini et al. [13] and show an increase of the initial signal intensity.

4. Quartz UV-RF simulations

4.1. Defining the model

In a first simulation attempt to reproduce the obtained experimental results, the comprehensive quartz model developed by Bailey [15] was used with minor modifications (see Table 2), since it is successful in simulating several TL and OSL phenomena in quartz. These modifications were necessary in order to simulate the RF curves obtained from our experiments.

Fig. 5 shows the energy-band diagram the model is based on. To better understand the modifications applied later, the main aspects of the model by Bailey [15] are listed briefly; for a detailed