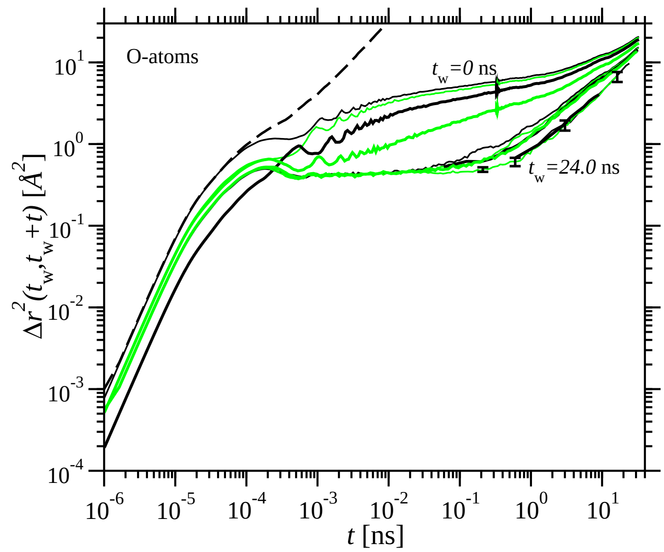

FIG. 10: (Color online) Mean square displacement $\Delta r^2(t_\mathrm{w}, t_\mathrm{w}+t)$ as defined in Eq. (7) for the temperature quench from 5000 K to 2500 K and for O-atoms. Waiting times and corresponding line styles are the same as in Fig. 4.

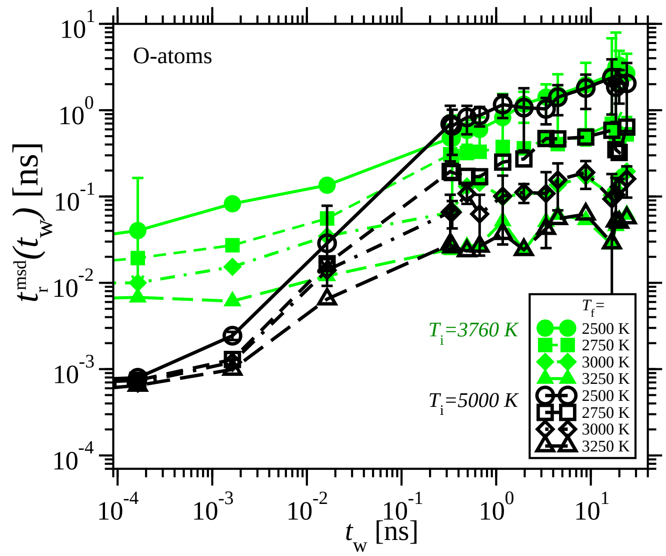

FIG. 11: (Color online) $t_\mathrm{r}^\mathrm{msd}$ for O-atoms. Symbols for the different $(T_\mathrm{i}, T_\mathrm{f})$ combinations are the same as in Fig. 7. Error bars are indicated exemplary for (3760 K, 2500 K), (5000 K, 2500 K) and (5000 K, 3000 K).

C. Mean Square Displacement

In the previous section, we have focused on the analysis of $C_q(t_\mathrm{w}, t_\mathrm{w}+t)$ and identified different time-windows. In this section, we consider the mean square displacement

$$\Delta r^2(t_\mathrm{w}, t_\mathrm{w}+t) \;=\; \frac{1}{N}\sum_{i=1}^{N}\left\langle \left(\mathbf{r}_i(t_\mathrm{w}+t)-\mathbf{r}_i(t_\mathrm{w})\right)^2\right\rangle \;. \quad (7)$$

Figure 10 shows $\Delta r^2(t_\mathrm{w}, t_\mathrm{w}+t)$ for the temperature quench from 5000 K to 2500 K and for O-atoms. As in Fig. 4, for times $t \lesssim 5\cdot 10^{-5}$ ns and zero waiting time, the mean square displacement $\Delta r^2(t_\mathrm{w}=0, t)$ is well approximated by Δr^2 of the high temperature $T_\mathrm{i} = 5000$ K from which the system has been quenched (see dashed line in Fig. 10) and thus independent of T_f. For times $t \approx 10^{-3}$ ns, $\Delta r^2(t_\mathrm{w}, t_\mathrm{w}+t)$ is oscillatory due to the small system size [31], while for times $t \gtrsim 10^{-3}$ ns and waiting times $t_\mathrm{w} \geq 0.33$ ns, we find that Δr^2 forms a plateau which is independent of t_w. As for C_q, we find that the plateau is the more horizontal the smaller T_f and the plateau height depends on the particle type but is independent of T_i.

For waiting times $t_\mathrm{w} \geq 0.33$ ns and times $t \gtrsim 0.1$ ns, the mean square displacement leaves the plateau and increases further. To characterize the dependence of this α-relaxation we define the time $t_\mathrm{r}^\mathrm{msd}$ as the time $t = t_\mathrm{r}^\mathrm{msd}$ for which $\Delta r^2(t_\mathrm{w}, t_\mathrm{w}+t_\mathrm{r}^\mathrm{msd}) = 1.35$ Å^2 (see Fig. 11). We can identify again the three time windows (I) of waiting times $t_\mathrm{w} \lesssim 0.3$ ns with a dependence on T_i, T_f and particle type, (II) the aging regime of intermediate waiting times where $t_\mathrm{r}^\mathrm{msd}$ follows roughly a power law, and (III) for very long waiting times when equilibrium is reached. The transition from (II) to (III) occurs at approximately the same times t_{23} as for C_q, i.e. $t_{23} \approx 0.3$ ns for $T_\mathrm{f} = 3250$ K, $t_{23} \approx 1$ ns for $T_\mathrm{f} = 3000$ K, $t_{23} \approx 3$ ns for $T_\mathrm{f} = 2750$ K and $t_{23} \approx 10$ ns for $T_\mathrm{f} = 2500$ K.

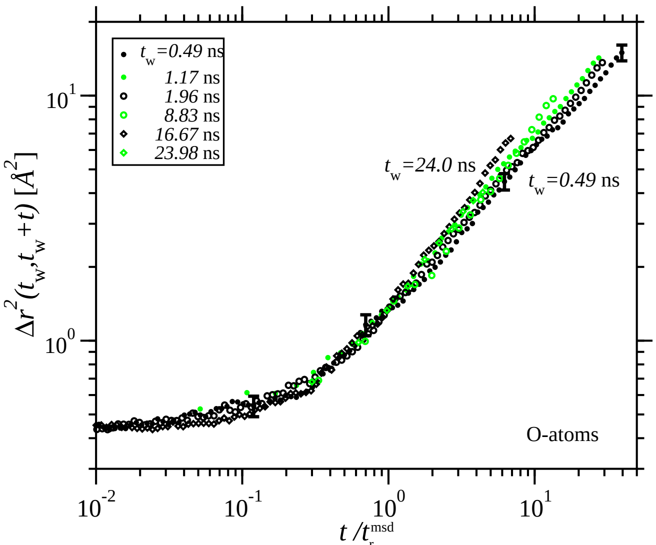

FIG. 12: (Color online) $\Delta r^2(t/t_\mathrm{r}^\mathrm{msd})$ for the temperature quench from 5000 K to 2500 K and for O-atoms.

Figure 12 shows the equivalent of Fig. 8 to test time superposition. We find for $\Delta r^2(t/t_\mathrm{r}^\mathrm{msd})$ that time superposition is valid for waiting times $0.34\,\mathrm{ns} \leq t_\mathrm{w} \lesssim 8.83$ ns, i.e. for the time window (II) but not for the time window (III).