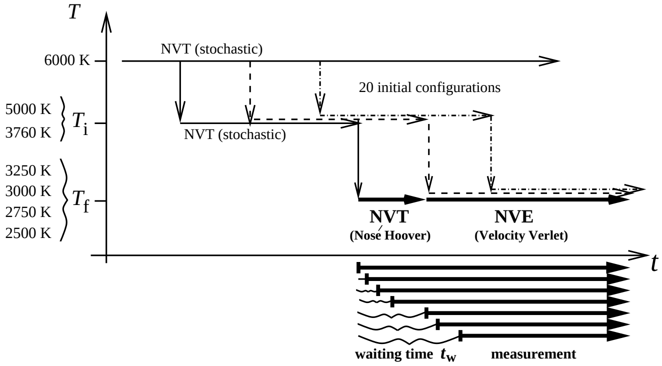

FIG. 1: Schematic sketch of the protocol for the simulation runs. 20 independent initial configurations are obtained via one long simulation run at 6000 K. For each independent configuration the system is quenched instantaneously and then fully equilibrated at temperatures $T_{\rm i} = 3760\,{\rm K}$ and 5000 K, followed by instantaneous quenches to the temperatures $T_{\rm f} = 3250\,{\rm K}$, $3000\,{\rm K}$, $2750\,{\rm K}$, and $2500\,{\rm K}$. At each $T_{\rm f}$, time-dependent correlation functions are determined for different waiting times $t_{\rm w}$. Temperature is kept constant at $T_{\rm f}$ by coupling the system to a Nosé-Hoover thermostat. The thermostat is switched off after 0.33 ns, followed by the continuation of the simulations in the microcanonical ensemble for 33 ns.

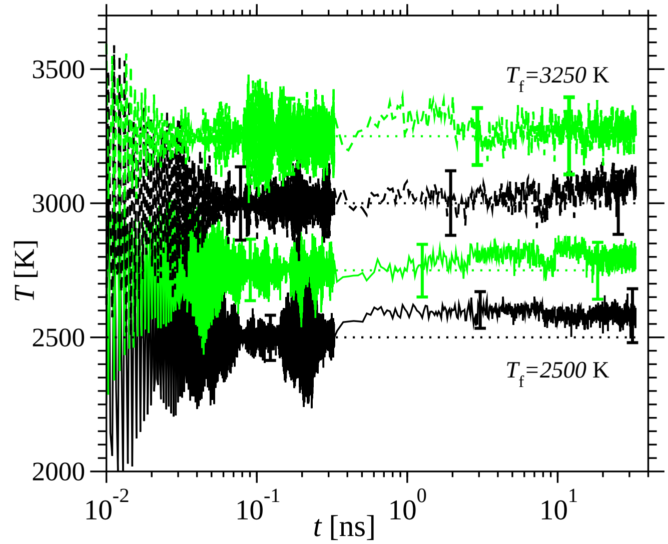

FIG. 2: (Color online) Temperature $T = \frac{2\overline{E}_{\rm kin}}{3N}$ as a function of time t for $T_{\rm i} = 5000\,{\rm K}$, $T_{\rm f} = 2500\,{\rm K}, 2750\,{\rm K}, 3000\,{\rm K}, 3250\,{\rm K}$ shown in each case for the 11th independent simulation run. $\overline{E}_{\rm kin}$ includes a time average and error bars indicate the corresponding fluctuations.

the initial temperatures $T_{\rm i} = 5000\,{\rm K}$ (for 16.35 ns) and $T_{\rm i} = 3760\,{\rm K}$ (for 32.7 ns), the system was quenched instantaneously to $T_{\rm f} \in \{2500\,{\rm K}, 2750\,{\rm K}, 3000\,{\rm K}, 3250\,{\rm K}\}$. To disturb the dynamics minimally, we used a Nosé-Hoover thermostat [45, 46] instead of a stochastic heat bath to keep the temperature at $T_{\rm f}$ constant. A velocity Verlet algorithm was used to integrate the Nosé-Hoover equations of motion (see Appendix A) with a time step of 1.02 fs. After 0.33 ns the Nosé-Hoover thermostat was switched off and the simulation was continued in the NVE ensemble for 33 ns using a time step of 1.6 fs. Whereas previous simulations used instead the NVT ensemble for the whole simulation run, we chose to switch to the NVE ensemble to minimize any influence on the dynamics due to the chosen heat bath algorithm. For the comparison with previous simulations and to check for the lack of a temperature drift, we show in Fig. 2 for exemplatory simulation runs the temperature $T = \frac{2\overline{E}_{\rm kin}}{3N}$ as a function of time where $\overline{E}_{\rm kin}$ is the time averaged kinetic energy with fluctuations as indicated with error bars. We find that even after switching off the heat bath [53] there is no temperature drift for $T = 3250\,{\rm K}$ and $T = 3000\,{\rm K}$ and for $T = 2500\,{\rm K}$ and $T = 2750\,{\rm K}$ there is only a slight temperature drift which is of the same order as the temperature fluctuations and the drift occurs only for $t \lessapprox 0.6$ ns. For all times $t \gtrapprox 0.6$ ns and for all investigated temperatures there is no temperature drift and thus the comparison with previous simulations valid.

III. RESULTS

In all following, we investigate how the structure and dynamics of the system depend on the waiting time $t_{\rm w}$ elapsed after the quench from $T_{\rm i}$ to $T_{\rm f}$. We varied the waiting time in the range $0\,{\rm ns} \le t_{\rm w} \le 23.98\,{\rm ns}$.

A. Partial Structure Factor

Figure 3 shows for the temperature quench $T_{\rm i} = 5000$ K to $T_{\rm f} = 2500$ K the partial structure factors [11]

$$S_{\alpha\beta}(q, t_{\rm w}) = \frac{1}{N} \left\langle \sum_{i=1}^{N_\alpha} \sum_{j=1}^{N_\beta} {\rm e}^{i\mathbf{q}\cdot\left(\mathbf{r}_i(t_{\rm w}) - \mathbf{r}_j(t_{\rm w})\right)} \right\rangle \qquad (2)$$

where $\mathbf{r}_i$ and $\mathbf{r}_j$ are the positions of particles i and j of species $\alpha, \beta = {\rm O}, {\rm Si}$. The partial structure factors for all other $(T_{\rm i}, T_{\rm f})$ combinations are very similar. Although Fig. 3 shows $S(q, t_{\rm w})$ for the largest investigated temperature quench, there is only a slight $t_{\rm w}$-dependence for very short waiting times $t_{\rm w} \le 0.33\,{\rm ns}$ and almost no $t_{\rm w}$-dependence for $t_{\rm w} \ge 0.33\,{\rm ns}$.

B. Generalized Incoherent Intermediate Scattering Function

In this section we focus on the time-dependent generalized intermediate incoherent scattering function [11]

$$C_q(t_{\rm w}, t_{\rm w} + t) = \frac{1}{N_\alpha} \left\langle \sum_{j=1}^{N_\alpha} {\rm e}^{i\mathbf{q}\cdot\left(\mathbf{r}_j(t_{\rm w}+t) - \mathbf{r}_j(t_{\rm w})\right)} \right\rangle \qquad (3)$$