

Electronic Supplementary Information: Radiation-Induced Reaction Kinetics of Zn^{2+} with e_s^- and $\text{Cl}_2^{\bullet-}$ in Molten LiCl-KCl Eutectic at 400-600 °C

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Salt Purification Apparatus Schematics

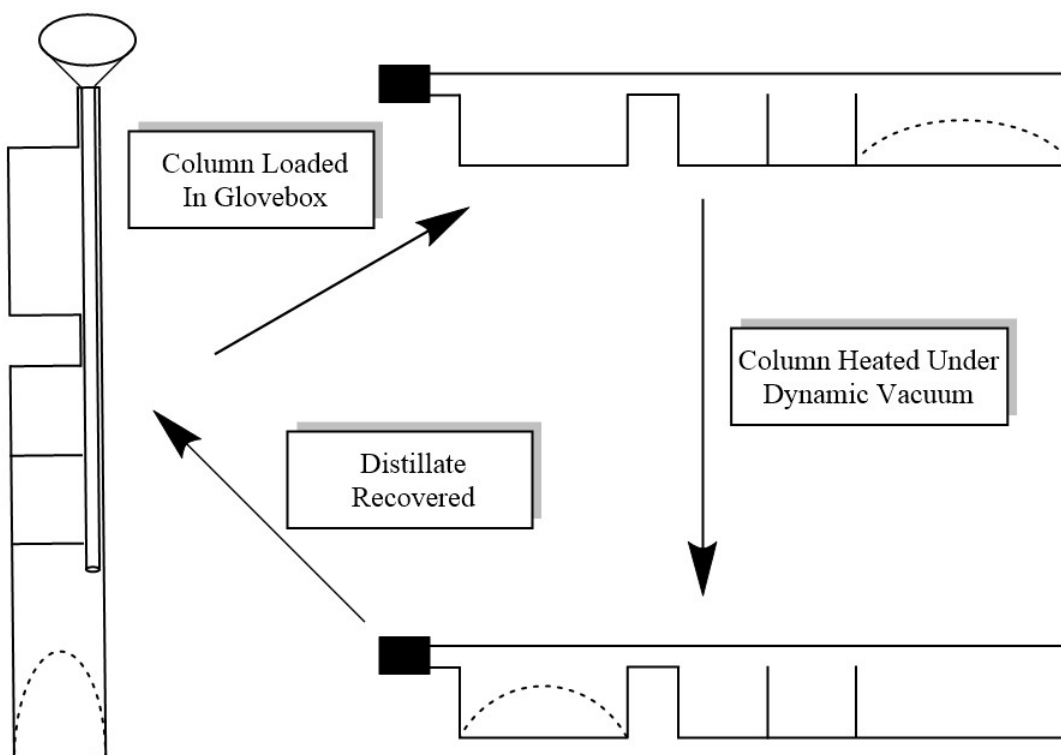


Fig. S1. Salt distillation process.

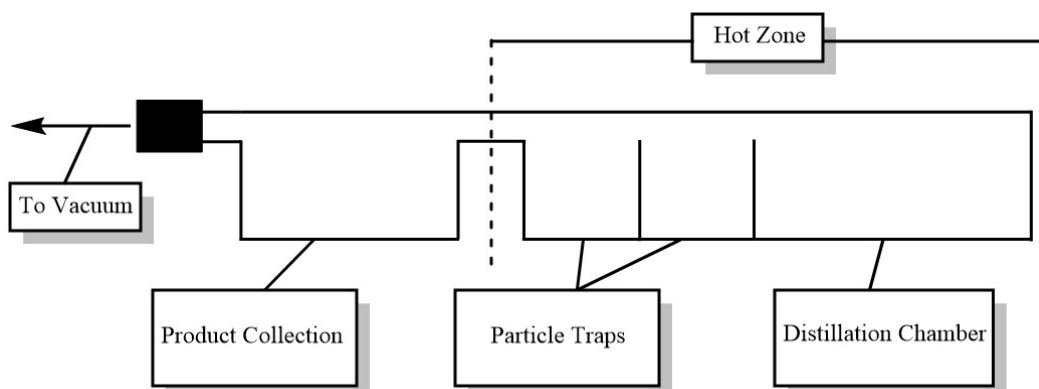


Fig. S2. Salt Distillation column.

High-Temperature-Controlled Van de Graaff Cuvette Holder

A new high-temperature cell holder for the presented Van de Graaff pulse radiolysis experiments is shown in **Fig. S4** below. It consists of an ambient air-cooled 25.4 x 21.5 x 50.8 mm SS304 stainless steel cell holder block wrapped with insulation (Rescor ceramic board secured with 3000°F RESBOND™ 989 fast set alumina adhesive). Two cartridge heaters (24 V 100 W Dalton Electric Heating Co., Inc., Watt-Flex® Split-Sheath Cartridge Heater) are located inside the block on the side away from the electron beam. The analysing light path is perpendicular to the electron beam. The holder has a 9 x 7.5 mm hole for the electron beam entrance and two 9 x 2 mm slits for the analysing light. The slits are located on opposite sides of the holder so that the analysing light crosses the sample cell within 2 mm of where the electron beam enters the cell, because the 2 MeV electron beam loses energy rapidly when traversing dense molten salt samples. A thermocouple is seated in the heating block less than 2 mm from the cell location. Temperature variations were determined to be less than $\pm 1.0^\circ\text{C}$ during each experiment. Measurements at a given temperature were made over a period of 5-10 minutes, and were found to be self-consistent, indicating that there was no temperature variation between measurements in this time frame.

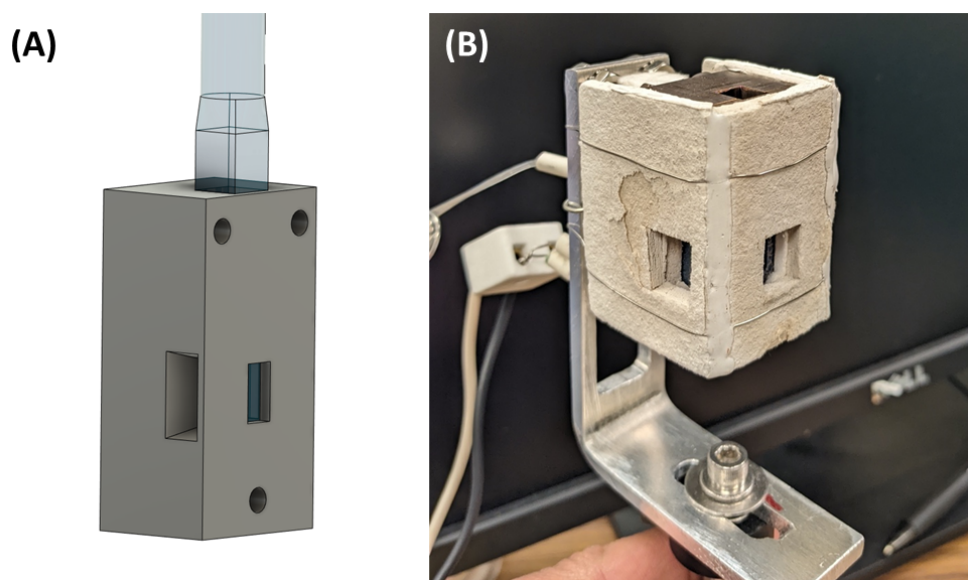


Fig. S3. High temperature cell holder for the Van de Graaff. **(A)** Schematic of the heating block showing how the sample cell is inserted. The electron beam enters the aperture centered in the side facing to the right. The analysing light enters the aperture on the left near the beam-facing side of the holder. **(B)** The mounted cell holder covered with insulation.

Temperature Dependent Reaction Kinetics at 700 nm

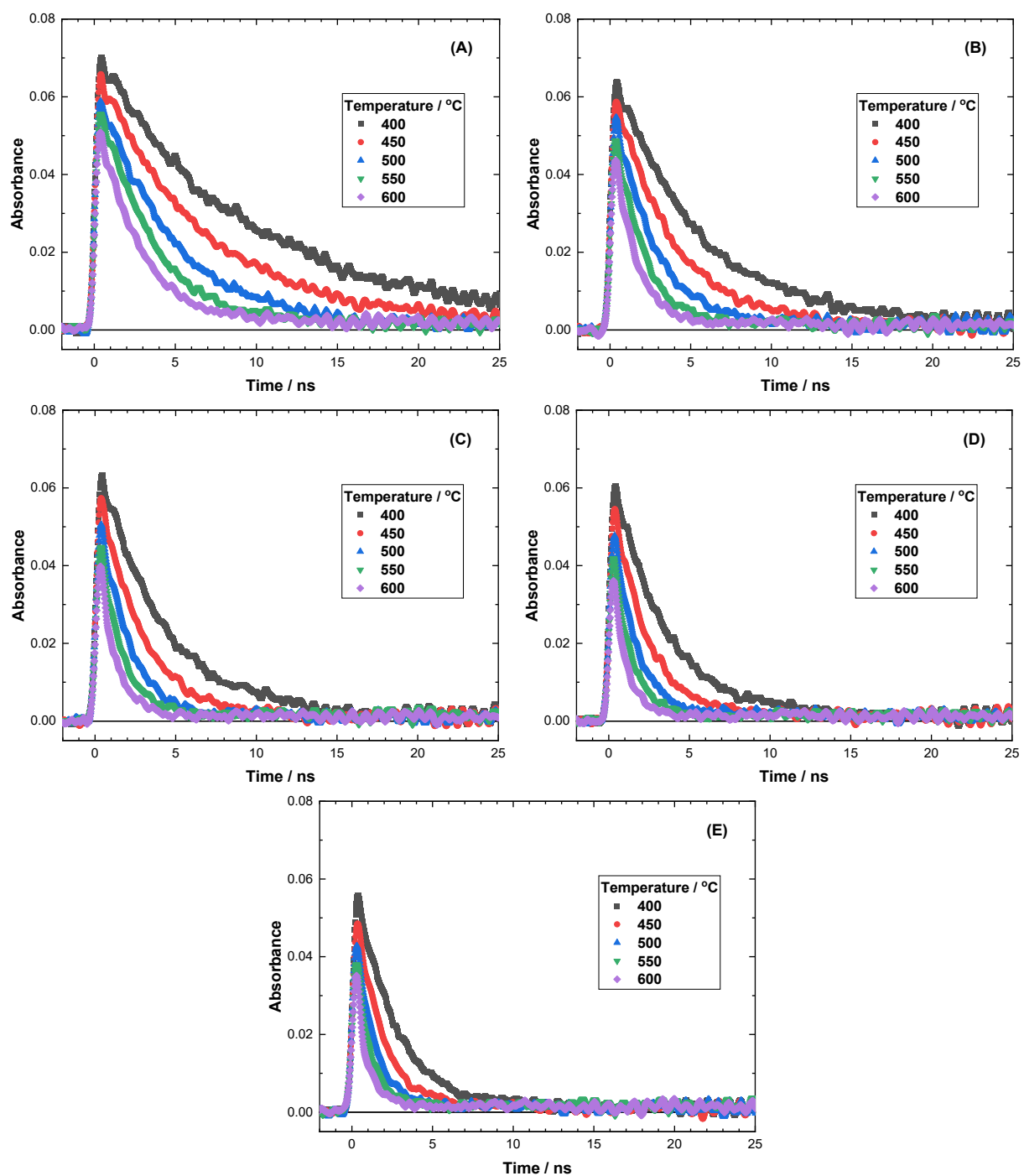


Fig. S4. Temperature dependent kinetics at 700 nm for 1.88 (A), 3.76 (B), 5.88 (C), 7.30 (D), and 9.41 (E) mM Zn^{2+} in LiCl-KCl.

Time Dependent Spectra at 400 °C

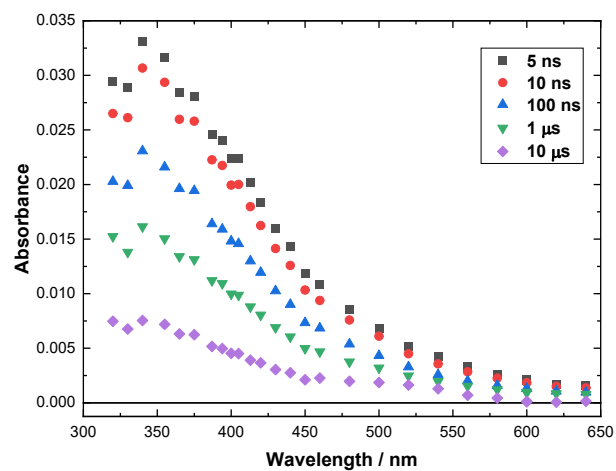


Fig. S5. Transient absorption spectra observed in neat ZnCl₂ at 400 °C: 5 ns (■), 10 ns (●), 100 ns (□), 1 μs (▼), 10 μs (◆).

240 nm Transient Absorption Kinetics at 400 °C

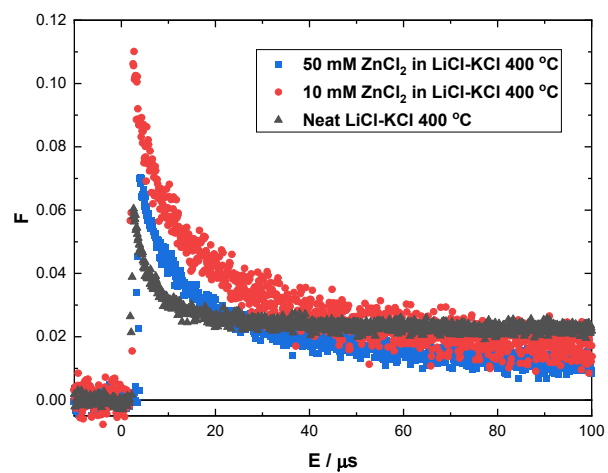


Fig. S6. Transient absorption kinetics at 240 nm: 0 (black), 10 (red) and 50 (blue) mM ZnCl₂ in LiCl-KCl at 400 °C.