Pressure-driven release and encagement of guests in hydroquinone clathrates

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Hydroquinone (HQ) clathrates are known to have capability to capture various guest molecules when they form the β-form clathrate structure by the interaction between hydrogen-bonded HQ host and quest molecules. The guest-free, CO_2-loaded, and methanol-loaded HQ clathrates were synthesized by gas-phase reaction and recrystallization, respectively. A high-pressure behavior of the HQ clathrates was observed using a symmetric diamond anvil cell up to 12 GPa. The CO_2- and methanol-loaded HQ clathrates transformed into the crystalline α-form HQ at ~5GPa, and recovered to their original β-form clathrates at ambient condition by decreasing pressure. In contrast, the guest-free HQ clathrate remained the crystalline α-form HQ at ambient condition when the pressure decreased after its structural transition to the crystalline α-form HQ at ~0.248GPa. This result provides a useful guide to determine the stability of structural integrity of organic clathrate compounds.