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Decomposition kinetics of gas hydrates and environmental ecology

V. A. Istomin (1), V. G. Kvon (2), E. M. Chuvilin (3), and A. N. Nesterov ()

(1) Joint-stock company "Novatek", Moscow, Russian (vlistomin@yandex.ru), (2) Joint-stock company "Gazprom-VNIIGAZ", Moscow Region, Russia, (3) Department of Geocryology, Moscow State University, Russia, (4) Institute of Earth Cryosphere, RAS, Tyumen, Russia

At present the serious attention is given to the analysis of cyclic climatic changes and metastable methane hydrates existence at natural conditions during its decomposition. Atmospheric methane as well as carbon dioxide is greenhouse gas approximately with 20 times more activity at the same concentration. There are some hypotheses dealing with an influence of gas hydrate decomposition on natural processes, for instance a hypothesis of so called "gas hydrate gun". Unfortunately in such numerous speculations some of interesting features and mechanisms of gas hydrate decomposition are not account. The purpose of the present work is to discuss important features of gas hydrate decomposition at different temperatures, including the effects of slowed decomposition (similar to self-preservation effect). We believe than the detailed physicochemical information on gas hydrate decomposition kinetics could be further included in various scenarios of paleogeocryogical reconstructions.
The following features of hydrate decomposition kinetics at negative temperatures (on Celsius) are considered:
1. A number of different stages of the decomposition process (induction time, fast initial stage and slowed second stage), influence of "driving forces" on decomposition kinetics.
2. Occurrence of some metastable water phases (supercooled water, amorphous and cubic ices) at initial stage of surface hydrate decomposition.
3. The stage of metastable water phases crystallisation/recrystallization.
4. Self- and forced-preservation effects with sharply slowed decomposition process.
5. Concurrences of the surface and the bulk mechanisms of hydrate decomposition.
Effects of the slowed hydrate decomposition also possible for positive temperatures (on Celsius), espacially for marine conditions. One important example is considered in detail: the reasons of different hydrate structures (cubic structures I and II or cubic structures II and H) coexistence at sea bottom.