Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18125

H2 generation from H-containing materials radiolysis in U-rich source rocks: a simulation experiment study

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Organic-rich source rocks, which are generally characterized by high uranium (U) contents, distribute widely around the world. Although the U belongs to trace element in source rocks, the continuous radiation of U during long geological history has released vast of radiation energy. It is still a question whether the vast radiation energy is responsible for H2 resource in nature. In order to explore the probability of H2 resource originated from U- and organic-rich source rocks, the H-containing materials in nature and artificial ones, including oil field water, Yellow Sea water, Weihe River water, distilled water, NaCl, CaCl2, KCl, MgCl2 solutions, decane, 3-tetradecylthiophene, bitumen, kerogen and cements with water (kaolinite, gypsum and montmorillonite) are selected to be subjected to cobalt (60Co) γ irradiation. The results show that the samples released variable yields of H2, and a weaker H-X bond energy (X indicates O, C or other element) in homogeneous materials, an increased solution concentration, the larger specific surface area and lower partial pressure of H2 correspond to increased H2 yields. The H2 production is positive with radiation dose, so that older source rocks with higher U contents are more probable origins of H2 resources. The experiment results prove that H-containing materials radiolysis in U-rich source rocks via U radiation can provide H2 for potential H2 resources and the total dose can be the parameter to measure the amount of H2 contributed by U radiation.