THERMOCHEMICAL SYSTEMS FOR HYDROGEN GENERATION. R. E. Hanneman and R. H. Wentorf,Jr.
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Closed-cycle thermochemical hydrogen production, using water and heat as input ingredients and yielding hydrogen, oxygen and degraded heat as products, through multi-step reactions with cycled chemical intermediates will be treated. The approaches, criteria and limitations for identification of potentially viable closed-cycle methods of water splitting will be described. Key features of a new closed-cycle process developed in our laboratory will be presented in terms of the above factors. Practical overall thermal efficiencies based on hydrogen combustion energy produced relative to endothermic nuclear heat supplied can range from less than 20 percent to more than 60 percent with maximum input temperatures of 750°C for the various systems analyzed in our study. Limitations due to corrosion, reaction kinetics, system complexity, ecological and economic factors will be briefly outlined. Closed-cycle approaches will be compared to evolving open-cycle methods of hydrogen production with a fossil fuel, such as coal, wherein water and heat are input ingredients and hydrogen, CO_2 and degraded heat are the idealized exit products. Other methods of hydrogen generation including electrolysis, mixed-cycle, photolysis, and biological means will be briefly discussed.